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ERRATUM

NSA, Vol. 6, No. 17. On p. 5 of Index, the abstract number for UCRL-1783 should be 6-4248, not 6-4218.

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AERE MED/R/-969 5929
Atomic Energy Research Establishment, Harwell, Berks (England)
AN INVESTIGATION INTO THE RELATION BETWEEN PHYSIOLOGICALLY LOW LEUCOCYTE COUNTS AND SICKNESS ABSENCE, by F. M. Turner. June 26, 1952. 12p. (AERE MED/R/-969)

AMRL-82 5948
Army Medical Research Lab., Fort Knox.
PROTECTIVE EFFECT OF SEROTONIN AND OF PARA-AMINOPROPIOPHENONE AGAINST LETHAL DOSES OF X-RADIATION, by John L. Gray, John T. Tew and H. Jensen. May 12, 1952. 10p. (AMRL-82; U-22905)

ML-165 6132
Microwave Lab., Stanford Univ.
PSEUDOSCALAR MESONS WITH APPLICATIONS TO MESON-NUCLEON SCATTERING AND PHOTOPRODUCTION, by S. D. Drell and E. M. Henley. Aug. 1952. 42p. (ML-165)

NBS-1214 6115
National Bureau of Standards
STATISTICAL MATRIX TECHNIQUES AND THEIR APPLICATION TO THE DIRECTIONAL CORRELATION OR RADIATIONS, by U. Fano. [nd] 64p. (NBS-1214)

NBS-1721 5997
National Bureau of Standards
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS; ANNUAL BIBLIOGRAPHY - 1949, by L. M. Brown, J. M. Goldstein, and C. W. Beckett. Aug. 1, 1952. 74p. (NBS-1721)

NBS-1762 6036
National Bureau of Standards
THERMALLY OPERATED GLASS VALVE TO PROVIDE VERY SMALL CONTROLLED GAS FLOW RATES, by Ralph Forman. June 27, 1952. 14p. (NBS-1762)

NP-3988 6034
Armour Research Foundation
V-NOTCH CHARPY FRACTURE TRANSITIONS OF 0.40% CARBON MEDIUM ALLOY TEMPERED MARTENSITE; REPORT NO. 36 (TECHNICAL REPORT), by M. Baeyertz, E. S. Bumps, and J. P. Sheehan. June 16, 1952. 34p. (NP-3988; Report No. 36; U-23294)

NP-3994 5984
Pennsylvania State Coll. School of Mineral Industries
THE SCREENING OF CATIONS AS A BASIC PRINCIPLE OF INORGANIC CHEMISTRY, by W. A. Weyl. July 1952. 76p. (NP-3994; Technical Report No. 52; U-23258)

NP-4009 6020
New York State Coll. of Ceramics, Alfred Univ.
HIGH TEMPERATURE RESISTANCE THERMOMETER TEMPERATURE CONTROLLER, by W. B. Crandall and P. M. Hackett. New York State Coll. of Ceramics, Alfred Univ. and Niagara Electron Labs. June 15, 1952. 13p. (NP-4009; U-23462)

NP-4013 6035
New Jersey Ceramic Research Station, Rutgers Univ.
TECHNICAL REPORT NO. 4 [ON] A METHOD SUITABLE FOR MEASUREMENT OF VISCOSITIES AT HIGH TEMPERATURE. Aug. 1, 1952. 14p. (NP-4013; Technical Report No. 4; U-23343)

NP-4024 6060
Illinois Univ.
A THEORY OF FATIGUE BASED ON A STATISTICAL DISTRIBUTION OF GRAIN SIZE, by M. E. Lanchick. July 1952. 88p. (NP-4024; Technical Report No. 32)

NP-4027 6122
Polaroid Corp.
INTERIM DEVELOPMENT REPORT FOR PHOSPHATE GLASS GAMMA-RADIATION DOSIMETER [FOR] PERIOD JULY 1 THROUGH JULY 31, 1952. Aug. 15, 1952. 33p. (NP-4027; U-22719)

NP-4028 6061
New York Univ.
TITANIUM-RICH TERNARY PHASE DIAGRAMS OF TITANIUM WITH MANGANESE AND CARBON, AND CHROMIUM AND CARBON; INTERIM TECHNICAL REPORT NO. 1, by E. Ence, W. Kirk, and H. Margolin. Mar. 17, 1952. 28p. (NP-4028; Interim Technical Report No. 1; WAL 401/105-9(pt.3))

NP-4029 6062
New York Univ.
TITANIUM-RICH TERNARY PHASE DIAGRAMS OF TITANIUM WITH MANGANESE AND NITROGEN, AND CHROMIUM AND NITROGEN, by E. Ence, W. Kirk, and H. Margolin. Mar. 24, 1952. 16p. (NP-4029; WAL-401/105-9(pt.II); Interim Technical Report No. 1)

NP-4041 5996
Institute for the Study of Rate Processes, Univ. of Utah
SOME FACTORS IN THE GROWTH OF CRYSTALS, by Dan McLachlan, Jr., Allan Carlson, Carl J. Christensen and Alan King. Jan. 1, 1951. 62p. (NP-4041; Technical Report No. 9; U-22139)

NP-4053 6063
Institute of Engineering Research, Univ. of Calif., Berkeley
FUNDAMENTAL STUDIES RELATED TO THE ORIGIN AND NATURE OF CREEP OF METALS; FOURTH TECHNICAL REPORT [ON] VARIATION OF PLASTIC PROPERTIES WITH ANNEALING PROCEDURE IN ZINC SINGLE CRYSTALS, by Choh Hsien Li, Jack Washburn, and Earl R. Parker. July 1952. 16p. (NP-4053; Technical Report No. 4; U-23666)

NP-4061 6064
Institute of Engineering Research, Univ. of Calif., Berkeley
FUNDAMENTAL STUDIES RELATED TO THE ORIGIN AND NATURE OF CREEP OF METALS; FIFTH TECHNICAL REPORT [ON] RECOVERY IN SINGLE CRYSTALS OF ZINC, by R. Drouard, Jack Washburn, and Earl R. Parker. July 1952. 15p. (NP-4061; Technical Report No. 5; U-23665)

NP-4062 6065
Institute of Engineering Research, Univ. of Calif., Berkeley
FUNDAMENTAL STUDIES RELATED TO THE ORIGIN AND NATURE OF CREEP OF METALS; SIXTH TECHNICAL REPORT [ON] EFFECT OF STRESS ON INITIAL CREEP RATE OF ZINC SINGLE CRYSTALS, by N. Brown, Jack Washburn and Earl R. Parker. July 1952. 14p. (NP-4062; Technical Report No. 6; U-23664)

NP-4066 6006
Centre de Physique Nucléaire de L'Université Libre de Bruxelles
PREPARATION DE GRAPHITE NUCLEAIREMENT PUR. [PREPARATION OF GRAPHITE OF HIGH NUCLEAR PURITY], by W. L. De Keyser and R. Cypres. June 1952. 37p. (NP-4066; Bulletin Note No. 35)

NP-4067 5989
Centre de Physique Nucléaire de L'Université Libre de Bruxelles
EMPLOI DE L'UX_1 COMME RADIOTRACEUR DANS LE DOSAGE DU THORIUM. [USE OF $UX_1(Th^{234})$ AS RADIOTRACER IN THE DETERMINATION OF THORIUM], by H. von Buttlar and N. Isaac. July 1952. 8p. (NP-4067; Bulletin Note No. 36)

NP-4071 5949
Environmental Health Center
RADIOLOGICAL HEALTH HANDBOOK. Simon Kinsman, Donald J. Nelson, Jr., Robert P. Christman, Morton I. Goldman, Henry J. L. Rechen, Richard F. Valentine, Arthur H. Wolff and Mitchell R. Zavon, comps. and eds. Sept. 1952. 261p. (NP-4071)

NP-4080 6123
Department of Mines and Technical Surveys (Canada)
THE USE OF GEIGER-MUELLER TUBES FOR THE DETERMINATION OF THE STATE OF EQUILIBRIUM OF THE RADIOELEMENTS IN URANIUM ORES, by Christian Lapointe. Aug. 6, 1952. 24p. (NP-4080; TR-101/52)

NP-4104 6052
Centre de Physique Nucléaire de L'Université Libre de Bruxelles
APPLICATION DE LA METHODE DU RaD A LA MESURE DE L'AGE "CHIMIQUE" D'UN MINERAL D'URANIUM. [APPLICATION OF THE RaD METHOD TO THE MEASUREMENT OF THE CHEMICAL AGE OF A URANIUM MINERAL], by F. Begemann, H. von Buttlar and F. G. Houtermans. Aug. 1952. 36p. (NP-4104; Bulletin Note No. 37)

NP-4106 5990
Department of Mines and Technical Surveys (Canada)
THE AMPEROMETRIC TITRATION OF FLUORIDE WITH THORIUM NITRATE, by A. Hitchen. Aug. 8, 1952. 7p. (NP-4106; TR-102/52)

TEI-245 6053
Geological Survey
METHODS OF ANALYSIS USED IN THE TREATMENT OF COLORADO PLATEAU CARNOTITE FOR AGE STUDIES, by Robert G. Milkey. Aug. 1952. 19p. (TEI-245)

TEI-269 6054
Geological Survey
TERMINOLOGY FOR STRATIFICATION AND CROSS-STRATIFICATION IN SEDIMENTARY ROCKS, by Edwin D. McKee and Gordon W. Weir. Arizona Univ. and Geological Survey. Sept. 1952. 17p. (TEI-269)

TEM-360 6055
Geological Survey
AIRBORNE RADIOACTIVITY SURVEYS IN THE MOJAVE DESERT REGION, KERN, RIVERSIDE, AND SAN BERNARDINO COUNTIES, CALIFORNIA, by R. M. Moxham. July 1952. 30p., 4 illus. (TEM-360)

TEM-445 6056
Geological Survey
RECONNAISSANCE FOR URANIFEROUS ROCKS IN NORTHEASTERN WIND RIVER BASIN, WYOMING, by H. A. Tourtelot. Aug. 1952. 14p. (TEM-445)

USNRDL-358 5951
Naval Radiological Defense Lab.
STUDIES ON THE TREATMENT OF INTERNAL RADIOACTIVE CONTAMINATION. II. PREVENTION OF DEPOSITION OF A FISSION PRODUCT BY SALTS OF ETHYLENE DIAMINE TETRAACETIC ACID, by S. H. Cohn, J. K. Gong and M. C. Fishler. Aug. 19, 1952. 19p. (USNRDL-358)

NUCLEAR SCIENCE ABSTRACTS

Vol. 6 November 15, 1952 No. 21

BIOLOGY AND MEDICINE

5925
Cancer Research Inst., New England Deaconess Hospital, Boston
HETEROTRANSPLANTATION OF HUMAN CANCER. I. IRRADIATED RATS, by Sheldon C. Sommers, Rosanna N. Chute and Shields Warren. Cancer Research Inst., New England Deaconess Hospital, Boston and Laboratory of Pathology, Harvard Cancer Commission. [nd] 11p. (AECU-2206)

Forty of seventy-five human cancers (53%) survived transplantation to irradiated rats, and five of ten second-generation implants grew and were also identified microscopically. Little evidence was found for active growth in most first-generation heterologous transplants. The technique described is considered sufficiently successful to warrant its wider use. (auth)

5926
Cancer Research Inst., New England Deaconess Hospital, Boston
HETEROTRANSPLANTATION OF HUMAN CANCER. II. HAMSTER CHEEK POUCH, by Rosanna N. Chute, Sheldon C. Sommers, and Shields Warren. Cancer Research Inst., New England Deaconess Hospital, Boston and Laboratory of Pathology, Harvard Cancer Commission. [nd] 8p. (AECU-2207)

Using the hamster cheek pouch, 30 of 65 human neoplasms were successfully transplanted. Second-generation transplantations were positive in 11 of 20 cancers, and third-generation maintenance in 3 of 6 cases. The method is relatively simple and appears to be of great potential value in growth studies of human cancer tissue. (auth)

5927
Cancer Research Inst., New England Deaconess Hospital, Boston
HETEROTRANSPLANTATION OF HUMAN CANCER. III. CHORIOALLANTOIC MEMBRANES OF EMBRYONATED EGGS, by Sheldon C. Sommers, Barbara A. Sullivan, and Shields Warren. [nd] Cancer Research Inst., New England Deaconess Hospital, Boston and Laboratory of Pathology, Harvard Cancer Commission. 8p. (AECU-2208)

Twenty-eight of 59 different human cancers successfully survived transplantation to the chorioallantoic membranes of egg embryos. A total of 620 incubated eggs were used. In terms of the 327 eggs whose embryos survived implantation, the positive harvest was 23%, with or without prior x irradiation. Sarcomas survived in about one-quarter of the eggs harvested, glandular carcinomas in one-fifth, and epidermoid carcinomas in one-seventh. The technique used is described. (auth)

5928
Cancer Research Inst., New England Deaconess Hospital, Boston
STRUCTURAL ALTERATIONS IN TISSUE SECTIONS ASSOCIATED WITH EMBEDDING FOLLOWING FREEZE DRYING, by Margaret W. Holt and Shields Warren. [nd] 8p. (AECU-2209)

Results are reported in a study of the cause of tissue distortion and structural artifacts in stained tissue sections for microscopic examination treated by the freeze-drying technique before embedding.

5929
Atomic Energy Research Establishment, Harwell, Berks (England)
AN INVESTIGATION INTO THE RELATION BETWEEN PHYSIOLOGICALLY LOW LEUCOCYTE COUNTS AND SICKNESS ABSENCE, by F. M. Turner. June 26, 1952. 12p. (AERE MED/R/-969)

The sickness and casualty records of 154 individuals with persistently low leukocyte counts were compared with those of a group of equivalent number, sex, and age structure. It was found that while the casualty rates were similar in both groups, the sickness rates of the low count group were significantly lower than those of the control group. No support can be given to the assumption that individuals with persistent low counts are more susceptible to illness than those with "normal" counts. (auth)

5930
Brookhaven National Lab.
GLUCOSE-6-PHOSPHATE DEHYDROGENASE IN LEUCONOSTOC MESENTEROIDES, by R. D. De Moss, I. C. Gunsalus and R. C. Bard. Brookhaven National Lab. and Indiana Univ. [nd] 21p. (BNL-1226)

Partial purification and characterization of a glucose-6-phosphate dehydrogenase from Leuconostoc mesenteroides are described; either triphosphopyridine or diphosphopyridine nucleotide is required as the coenzyme. The existence of this enzyme, considered with previously published data, indicates the operation of a fermentative hexosemonophosphate pathway during glucose fermentation by L. mesenteroides. (auth)

5931
Atomic Energy Project, Univ. of Calif., Los Angeles
FURTHER STUDIES ON THE EFFECTS OF A SMALL INTESTINAL MICROSOMAL FRACTION UPON TRANSPLANTED LYMPHOSARCOMA, by Leslie R. Bennett, Frank E. Connon, Mary L. Gouze and Melvin D. Schoenberg. Issued Sept. 15, 1952. 15p. (UCLA-223)

A tissue fraction inhibitory to development of Gardner lymphosarcoma was prepared from small intestines of mice or rats by ultracentrifugation at 90,000 × g. Inhibitory activity was demonstrated by pre-inoculation exposure of lymphosarcoma cell suspensions to the fraction. The material significantly reduced the respiratory rate of lymphosarcoma, but, with the exception of spleen and thymus, did not affect oxygen consumption of normal tissues. The active substance is soluble in alcohol and in petroleum ether, and is apparently a moderately labile, naturally occurring lipid. Inhibitory properties of the microsomal material from the small intestine are destroyed or inactivated by serum. (auth)

5932
PREPARATION OF RADIOACTIVE PLASTIC MICROSPHERES. Manuel Tubis and Howard I. Jacobs. Nucleonics 10, No. 9, 54(1952) Sept.

Radioactive plastic microspheres have been used in studies of coronary occlusion and might be useful in many other physiological investigations. Their radioactivity permits radioautographs to be made of sections as thick as 1 cm.

Laboratory instructions for preparing I^{131}-tagged spheres are outlined.

RADIATION EFFECTS

5933

Applied Fisheries Lab., Univ. of Wash.

WORK IN PROGRESS AT THE APPLIED FISHERIES LABORATORY. [Jan.] 1952. Decl. Sept. 8, 1952. 15p. (AECD-3445; UWFL-29)

A comparison was made between the radiosensitivity of dry, encysted eggs of Artemia and similar eggs after resumption of development stimulated by soaking in water. Dry eggs were found to be twice as resistant as soaked eggs. Studies were initiated in the effects of various stages of development on radiosensitivity of snail eggs. Preliminary analysis of data from studies of the effects of graded doses of x radiation on salmon eggs indicate that radiosensitivity decreases rapidly with age up to formation of the optic capsules. The relation of radioactivity to particle size was determined for sand from Eniwetok Atoll. Preliminary studies indicate that the activity from a solution of the mixed fission products from Eniwetok test-site sand is concentrated in goldfish primarily in the scales. Tissue distribution studies of Ce^{144} in goldfish are reported. Preliminary data are reported from studies of the effects of water of various temperatures on physiological processes in salmon. Studies that have been conducted with trace amounts of Co added to the diet of anemic salmon have indicated an improvement of the red blood cell count.

5934

Applied Fisheries Lab., Univ. of Wash.

RADIOBIOLOGICAL SURVEY OF BIKINI, ENIWETOK, AND LIKIEP ATOLLS; JULY - AUGUST 1949. July 12, 1950. Decl. Sept. 15, 1952. 146p. (AECD-3446; UWFL-23)

Specimens of fish, marine invertebrates, algae, plankton, land plants, land vertebrates, and water samples were collected for radioassay and identification from Bikini, Eniwetok, and the control area of Likiep. Frozen samples were processed in the Applied Fisheries Laboratory, and after ashing and plating, were counted in an internal gas-flow chamber. The unit of measurement used for reporting activity was disintegrations per min per g of tissue. The greatest amount of radioactivity was noted in the viscera of herbivorous fish from areas close to shot centers. A high of 1364 d/g/min was recorded. Radioactivity of invertebrates ranged from practically zero to as high as 1,500 d/g/min in starfish from the target areas. Samples of algae from near the target area at Eniwetok gave counts as high as 1700 d/g/min. The activity of plankton samples from the Bikini target area was three times greater and from the Eniwetok target area eight times greater than controls. Areas adjacent to collecting stations were monitored with beta-gamma survey instruments. Peaks of activity were found at the bomb site and in the 300-yard area, and from there on decreased rapidly. Alpha activity of water samples was not significantly greater than control samples of sea water, and was less than laboratory tap water.

5935

Brookhaven National Lab.

RADIATION STERILIZATION. I. THE EFFECT OF HIGH ENERGY GAMMA RADIATION FROM KILOCURIE RADIOACTIVE SOURCES ON BACTERIA, by William Tarpley, Jan Ilavsky, Bernard Manowitz, and Robert V. Horrigan. Brookhaven National Lab. and Schering Corp. [nd] 14p. (BNL-1227)

The successful sterilization of steroid suspensions heavily contaminated with bacteria by γ rays produced by kc sources of Co^{60} and Ta^{182} is reported. Radiation doses of between 2.7 and 3.2 rep $\times 10^6$ were required for sterilization. Irradiation at lower intensity, over relatively long periods of time, had no important bearing on the efficiency of sterilization. From results of this study it was concluded that many thicknesses of the material to be sterilized may be arranged around a radioactive source, thus providing high utilization efficiency of the radiation field.

5936

Brookhaven National Lab.

VEGETATIVE AND FLORAL DEVELOPMENT OF IRRADIATED AND NON-IRRADIATED PLANTS OF TRADESCANTIA PALUDOSA, by James E. Gunckel, Arnold H. Sparrow, Ielene B. Morrow, and Eric Christensen. [nd] 45p. (BNL-1228)

Plants of Tradescantia paludosa were exposed to chronic γ irradiation from a Co^{60} source for periods up to four months. The gross aspects of vegetative and floral growth and development are described in detail in both irradiated and non-irradiated plants. Observations were made on fourteen different intensities of radiation, varying from 1.6 to 113 r per day. Response varied from essentially normal growth to almost complete growth inhibition at 86.2 and 113 r per day. A number of extreme morphological aberrations were observed in the range between 12.7 and 37.2 r per day. Evidence suggests that auxin or the mechanism of auxin synthesis is a prime site of radiation effects.

5937

Brookhaven National Lab.

THE CALCULATION OF RADIATION DOSES TO P^{32}-LABELLED MALE DROSOPHILA MELANOGASTER, by R. C. King. [nd] 11p. (BNL-1230)

It is calculated that about 12.6% of the total energy dissipated by β particles originating from internally decaying P^{32} is absorbed by the tissue of male Drosophila melanogaster. Radiation contributed to the gonad by P^{32}-labeled tissue of the head and thorax is negligibly small when compared to that contributed by abdominal tissue. A method is described which enables the calculation of the geometrical factor necessary for determining the radiation dose to the male gonad. A method is described for experimentally checking the calculated absolute values for the radiation dose to the gonad. (auth)

5938

Brookhaven National Lab.

THE ROLE OF IONIZING RADIATION IN ELICITING TUMORS OF THE PITUITARY GLAND IN MICE, by Aubrey Gorbman and Abraham Edelmann. Brookhaven National Lab. and Columbia Univ. [nd] 5p. (BNL-1232)

Pituitary tumors do not form after radiothyroidectomy of C^{57} mice by small amounts of I^{131} but result when such radiothyroidectomy is followed by whole-body x irradiation, or by larger amounts of I^{131}. Similar doses of x rays alone do not lead to growth of the tumors. It appears that ionizing radiation induces these atypical growths in pituitaries physiologically altered by radiothyroidectomy. (auth)

5939

Brookhaven National Lab.

STUDIES WITH RADIOPHOSPHORUS IN DROSPHILA. I. THE MUTAGENIC EFFECTIVENESS OF RADIOACTIVE PHOSPHORS IN ADULT MALE DROSOPHILA MELANOGASTER, by Robert C. King. [nd] 36p. (BNL-1237)

The mutagenic effectiveness of radiophosphorus in Drosophila melanogaster has been studied using the Muller-5 method for recovering sex-linked recessive lethal mutations. Methods are described for varying the radiation dose from the radioactive medium and the radiation dose from P^{32} in tissue with respect to each other. The radiation dose from the medium is determined by actual measurement, while the radiation dose to the male gonad from P^{32} in tissue is calculated. It is shown that radiations from internally located P^{32} atoms are mutagenically effective. However, in the case of

male Drosophila fed upon P^{32} as adults there is no indication that internal P^{32} is more efficient mutagenically than external P^{32}. Among the genetic changes recovered following P^{32}-treatment are sex-linked recessive lethal mutations, sex-linked viable mutations, inversions and dominant lethals. P^{32} treatment also increases somatic crossing over and produces potential chromosome breaks leading to the production of unilateral mosaicism. The importance of this work in the study of genetic effects ascribable to the actual transmutation of P^{32} to S^{32} is discussed. (auth)

5940

Tennessee Univ.

AGRICULTURAL RESEARCH PROGRAM QUARTERLY PROGRESS AND WORK ACCOMPLISHMENT REPORT FOR QUARTER ENDING JUNE 30, 1952. [nd] 156p. (ORO-77)

In a comprehensive study of Cs metabolism, data on the tissue distribution and fetal transfer in rats, milk secretion in dairy cows, and tissue distribution and excretion by beef cattle are reported. It was shown that there may be a relatively high accumulation of radiocesium in milk and meat products from domestic animals exposed to this element, and ingested Cs^{137} may be a significant source of whole-body irradiation. A limited study was completed on the distribution of orally administered Sr in the tissues of the laying hen and in the various parts of the egg. In general, the metabolism of Sr was quite similar to that previously observed and reported for Ca. Preliminary data from a study of the effect of fluorine on the metabolism of Ca in the bones of the growing pig show high dietary fluorine causes a dysfunction at the epiphysis which results in decreased bone growth and a dysfunction in the primary and secondary spongiosa which resulted in an increased rate of bone resorption. The use of autoradiograms to measure bone growth is demonstrated. Data from studies demonstrate the lowest level of whole-body radiation received by the male rabbit which produces a demonstrable effect upon fetal mortality among his offspring lies between 50 and 100 r. A careful analysis of data on swine and burros indicates no effect of body size on the lethal response or the time of survival following total-body γ irradiation in doses ranging from 455 to 1230 r. No effects of whole-body irradiation was demonstrated on the anterior pituitary function in swine. Data are reported showing the effect of whole-body irradiation on the blood clotting mechanism in the burro. Blood chemistry values are presented for normal and irradiated burros. Following irradiation, slight changes occurred in NPN, protein, glucose, and cholesterol, while marked changes occurred in the alkaline phosphatase levels. No significant changes were observed for chloride, albumin, globulin, A/G ratio, lactic acid, inorganic phosphorus, glutathione, calcium, cholinesterase, thymol turbidity, or serum amylase.

5941

EFFECT OF PERIPHERAL SHIELDING ON LYMPHOID TISSUE RESPONSE TO IRRADIATION IN C 57 BLACK MICE. Henry S. Kaplan and Mary B. Brown. Science 116, 195-6 (1952) Aug. 22.

C 57 black mice, aged 33 ± 3 days, had Pb shields placed over the right thigh during each of four exposures to 168 r of x rays at 6-day intervals. It was observed that the initial radiation injury to the thymus was not affected by the shielding, but that thymic recovery was significantly accelerated. Lymph node recovery also was accelerated, although to a lesser degree. A relation between the effects of thigh shielding on thymic recovery and on inhibition of thymic lymphomas is suggested.

5942

THE EFFECT OF OXYGEN CONCENTRATION ON X-RAY-INDUCED CHROMOSOME BREAKAGE IN MAIZE. Drew Schwartz. Proc. Natl. Acad. Sci. U. S. 38, 490-4(1952) June.

Experiments performed on the irradiation of pollen in air and 100% nitrogen atmospheres have demonstrated the effect of low oxygen concentration on the radiosensitivity of maize chromosomes. The differential protection of low oxygen tension against interstitial and terminal deletions suggests that the effect of oxygen is exerted on the recovery process rather than on the initial breakage mechanism. (auth)

5943

REGENERATION OF X-RAY-IRRADIATED EXTREMITY OF AXOLOTL ON TRANSPLANTATION OF UNSPECIFIC TISSUES. V. F. Sidorova. Doklady Akad. Nauk S.S.S.R. 81, 297-9(1951) Nov. (In Russian)

The right hind extremity of the axolotl was amputated after both hind extremities had been irradiated with x rays. The regenerative capacity, which normally is inhibited entirely by prior x irradiation, was restored by implanting near the wound pieces of internal organs of the axolotl or muscle tissue of frogs.

5944

THE NATURE OF THE SERUM IODINE AFTER LARGE DOSES OF I^{131}. Jacob Robbins, J. E. Rall, David V. Becker, and Rulon W. Rawson. J. Endocrinal. and Metab. 12, 856-74(1952) July.

The serum radioiodine was studied in 11 patients following "tracer" doses of I^{131}. More than 90 per cent of the serum radioiodine was precipitable with the Somogyi reagents, and 70 to 89 per cent was extractable with n-butanol. In 10 of 16 patients who were studied after "therapeutic" doses of I^{131}, it was found that although the serum radioiodine was largely precipitable, only from 12 to 66 per cent was butanol-soluble. After alkaline hydrolysis, the butanol-insoluble radioiodine fraction was shown to release, thyroxine, diiodotyrosine, and iodide in proportions comparable to those found in thyroglobulin. The occurrence of this abnormal material in the blood appeared to be related to the amount of radiation delivered to the thyroid tissue, and was most pronounced in those patients who had the most severe radiation damage. In some patients, the presence of butanol-insoluble radioiodine in the serum was accompanied by a rise in serum protein-bound stable iodine. This material did not appear to produce a calorigenic effect. It has also been demonstrated that the serum radioiodine elaborated by functioning carcinoma of the thyroid appears to be identical with thyroxine. (auth)

5945

INTRAPLEURALLY INJECTED COLLOIDAL Au^{198} AND GROWTH AND IMPLANTATION OF FREE TUMOR CELLS IN PLEURAL EXUDATE. Horace Goldie, Harold D. West, Barbara R. Jeffries, and Charles H. Butler. Proc. Soc. Exptl. Biol. Med. 80, 327-31(1952) June.

Results of a study of the effect of intrapleurally injected colloidal Au^{198} on the growth of free tumor cells in the pleural cavity of mice, and on the induction of tumors by injection of cells from Au^{198}-treated pleural tumors are reported.

5946

EFFECTS OF BETA RAYS UPON A SINGLE NERVE FIBER. Hisao Yamashita and Tomoharu Miyasaka. Proc. Soc. Exptl. Biol. Med. 80, 375-7(1952) June.

Physiological investigations have been made of the response of a single nerve fiber to beta rays. Small exposures, up to 20 millicurie-hours at a distance of 1 mm in air and 10-μ mica, showed no effect. Moderate exposures (20 to 30 mc-hr) evoked an injury current from the irradiated region. At higher exposures, the threshold value of stimulus increased and the action current decreased in strength and duration, and ultimately disappeared at 70 millicurie-hours. Complete breakdown occurred at the highest doses. (auth)

5947

FETAL X-IRRADIATION AND FERTILITY. Roberts Rugh. Proc. Soc. Exptl. Biol. Med. 80, 388-95(1952) June.

An investigation of the effect of high but sub-lethal exposures to x irradiation on the subsequent fertility of mice exposed in utero showed various degrees of sterility at six months of age. Ten pregnant females, producing the litters studied, were all made sterile by 300-r irradiation administered in doses of 50 r on six consecutive days. Within any single litter variations in response of fetuses were found, indicating a slight spread in the developmental stage of the gonad primordia at the instant of irradiation. Data indicate the precursors of the Sertoli cells, interstitial tissue, and ovarian stroma are radioresistant, while the primordia of the maturation stages and ovarian germinal nests are definitely radioresistant. Exposure of the mouse fetus to 300-r x irradiation produced sterility in roughly two-thirds of all offspring, with slightly greater sterility among males.

RADIATION HAZARDS AND PROTECTION

5948

Army Medical Research Lab., Fort Knox.

PROTECTIVE EFFECT OF SEROTONIN AND OF PARA-AMINOPROPIOPHENONE AGAINST LETHAL DOSES OF X-RADIATION, by John L. Gray, John T. Tew and H. Jensen. May 12, 1952. 10p. (AMRL-82; U-22905)

The survival rate of rats exposed to lethal x-ray dosage was significantly increased after pretreatment with serotonin creatinine sulfate (20 mg/kg) or p-aminopropiophenone (32 or 16 mg/kg). The protective effect of those agents is assumed to be due to their property of producing temporary tissue anoxia. (auth)

5949

Environmental Health Center

RADIOLOGICAL HEALTH HANDBOOK. Simon Kinsman, Donald J. Nelson, Jr., Robert P. Christman, Morton I. Goldman, Henry J. L. Rechen, Richard F. Valentine, Arthur H. Wolff and Mitchell R. Zavon, comps. and eds. Sept. 1952. 261p. (NP-4071)

This handbook contains a large amount of readily available information of interest to anyone working in the field of radiation. Sections are included on signs and symbols, constants and conversion factors, equations, mathematical tables, electromagnetic spectrum and atomic data, glossary, survey and monitoring data, radioactivity assay data, x-ray data, biological data, and appendixes containing a table of isotopes and isotope decay table.

5950

Radiation Lab., Univ. of Calif., Berkeley

X-RAY DOSAGE TO PATIENTS UNDERGOING ORAL ROENTGENOGRAPHY, by W. E. Nolan. July 16, 1952. 10p. (UCRL-1882)

This report endeavors to point out the radiation hazards involved with respect to the patient undergoing oral roentgenography. The dose rate can be as high as 280 r/min. Very definite hematological changes have been observed and are being thoroughly investigated. Recommendations have been suggested to eliminate overexposures. (auth)

5951

Naval Radiological Defense Lab.

STUDIES ON THE TREATMENT OF INTERNAL RADIOACTIVE CONTAMINATION. II. PREVENTION OF DEPOSITION OF A FISSION PRODUCT BY SALTS OF ETHYLENE DIAMINE TETRAACETIC ACID, by S. H. Cohn, J. K. Gong and M. C. Fishler. Aug. 19, 1952. 19p. (USNRDL-358)

It has been demonstrated that the administration of sodium EDTA followed by calcium EDTA starting soon after Y^{91} injection can measurably reduce the internal radiation hazard by preventing skeletal fixation of the radioisotope. In like manner, the administration of the above salts of EDTA prior to injection of Y^{91} results in a skeletal yttrium concentration only a small fraction of that found in the controls. This work suggests the feasibility of a prophylactic approach to the problem of treatment of internal radioactive contamination in terms of preventing the skeletal deposition of fission products before, or soon after, exposure. (auth)

5952

QUANTITY OF ENERGY ABSORBED BY THE ORGANISM IN X-RAY DIAGNOSTIC STUDIES. Carlo Picchio and Carlo Martinenghi. Radiologia Med. 38, 665-9(1952) July. (In Italian)

The total energy received during x-ray diagnosis is compared with that administered during x-ray therapy. After insisting that the skin dose must be distinguished from the volume dose, the authors emphasize that diagnostic exposures are often of the order of radiotherapy exposures. The most advantageous conditions for reducing radiation damage to humans are discussed.

5953

PRECAUTIONS IN HANDLING RADIOACTIVE ISOTOPES. J. W. J. Fay. Brit. Med. Bull. 8, 246-53(1952).

The nature of hazards encountered in handling radioisotopes, units of measurement of radioactivity, maximum permissible doses, monitoring of personnel, monitoring of working areas, permissible contamination levels, design and lay-out of radiation laboratories, shielding, general precautions and disposal of waste are discussed.

5954

SALE OF URANIUM CONTAMINATED STEEL SCRAP RECOMMENDED. Hanson Blatz. Iron Age 170, No. 13, 125-7(1952) Sept. 25.

Release of U-contaminated steel scrap to commercial scrap channels has been recommended by a division of the Atomic Energy Commission. A study conducted by the Health and Safety Division of the New York Operations Office indicates use of the scrap will not affect personal health or the steel product made from the contaminated scrap. If sold through commercial channels, AEC will save money now spent in shipping contaminated steel to central points and will benefit from sale of scrap. No effects harmful to the photographic or instrument industries are foreseen.

5955

RADIATION GENETICS. 1. GENETIC ASPECTS OF RADIATION RISKS. Alma Howard. Brit. J. Radiology 25, 177-9(1952) April.

The need for a policy with regard to the amount of radiation permissible to man based on genetic grounds is stressed. The effects of mutant genes are summarized. Studies made of radiation-induced mutations in animals are reviewed.

5956

PREPROTECTION OF MICE AGAINST X-IRRADIATION MORTALITY BY SODIUM NITRITE. L. J. Cole, V. P. Bond, and M. C. Fishler. Science 115, 644-6(1952) June.

Preliminary results demonstrate the protective effects of Na nitrite against x-ray-induced mortality of mice when administered prior to irradiation. A summary of results of three separate experiments is presented in tabular form.

RADIOGRAPHY

5957

TECHNIQUES OF AUTORADIOGRAPHY AND THE APPLICATION OF THE STRIPPING-FILM METHOD TO PROBLEMS OF NUCLEAR METABOLISM. S. R. Pelc. Brit. Med. Bull. 8, 132-5(1952).

A review.

5958

DEPTH-DOSE DATA FOR ROENTGEN RADIATION AT 30-100 KILOVOLTS. H. C. Burger, R. Braams, and J. F. C. Werz. Acta Radiol. 37, 531-42(1952) June.

With a view to clinical application, the authors have investigated the influence of different parameters (voltage, filter, diaphragm) on depth-dose curves for x rays between 30 and 100 kv from a tube with an inherent filter of 1.0-mm Al. Curves are given for depths up to 5 cm in a perspex phantom. The influence of sulfur in the skin and the backscatter from bone were measured and found not to be of great importance. (auth)

RADIOTHERAPY

5959
Cancer Research Inst., New England Deaconess Hospital, Boston
THE INTRACAVITARY ADMINISTRATION OF Au 198. [nd] 6p. (AECU-2210)

Good preliminary results are reported in the treatment of patients with carcinoma of the lung in whom radiogold has been instilled post-operatively into the empty hemithorax. Radiogold is given with the object of possibly destroying any remaining cancer tissue in the cavity not accessible to surgery. Methods of administration and dosage are discussed.

5960
Oak Ridge Inst. of Nuclear Studies
SPECIAL REPORT OF THE MEDICAL DIVISION ON TELETHERAPY DESIGN PROBLEMS: Cs^{137}, by Marshall Brucer. May 15, 1952. 69p. (TID-5086(1st Rev.))

A review is presented of teletherapy design problems and the current status of the production of multicurie sources suitable for teletherapy units. It is stated that Cs^{137} sources, which are made from waste products in the neutron economy, should be the cheapest of all sources once the manufacturing plant is set up. For radiotherapy purposes, there is no limit to the number which can be produced. The specific activities are limited to about 25 c per g and the source must be replaced every 30 to 50 years. There is no significant change in output from year to year. Cs^{137} is produced as a Cs_2SO_4 salt and must be contained in a sealed housing. The completed fabrication of a small experimental Cs^{137} source and a 2000-c source in production are reported. Data are presented for the design of Cs^{137} teletherapy machines.

5961
RADIOIODINE IN THYROID CANCER. Ralston Paterson, H. C. Warrington, and C. W. Gilbert. Brit. Med. Bull. 8, 154-7(1952).

The selective uptake of I^{131} by thyroid cancer, the use of I^{131} in tracer examinations, clinical forms of thyroid cancer, methods of treatment, and techniques to enhance the uptake of I^{131} by thyroid cancer are discussed. Case histories are reviewed.

Note: Although no attempt is made in NSA to cover the fields of cancer therapy or of I^{131} thyroid therapy, attention is called to Issue No. 2-3 of the above journal containing this and other such articles.

5962
INTRACAVITARY IRRADIATION WITH RADIOACTIVE COLLOIDAL GOLD IN THE PALLIATIVE TREATMENT OF MALIGNANT PLEURAL AND PERITONEAL EFFUSIONS. R. J. Walton and W. K. Sinclair. Brit. Med. Bull. 8, 165-72(1952).

The use of colloidal Au^{198} in the palliative treatment of patients with pleural effusion or ascites and of patients with peritoneal spread of cancer but no ascites is discussed. Preparation and measurement of the source, distribution of Au in the body, symptoms after treatment, distribution of colloidal Au demonstrated at post-mortem examination, distribution of activity as determined by external counting, β and γ dosimetry, the integral dose and results of treatment using Au^{198} are discussed.

5963
RADIOACTIVE SOLUTIONS (^{24}Na AND ^{82}Br) IN THE TREATMENT OF CARCINOMA OF THE BLADDER. R. J. Walton and W. K. Sinclair. Brit. Med. Bull. 8, 158-65(1952).

Equipment, clinical considerations, radiation technique and dose, and results obtained by intracavity irradiation of the bladder with solutions of Na^{24} and Br^{82} in carcinoma of the bladder are discussed.

TOXICOLOGY STUDIES

5964
Brookhaven National Lab.
EFFECTS OF ALKALI METAL IONS ON DEVELOPMENT OF DROSOPHILA WITH SPECIAL REFERENCE TO LITHIUM INDUCED ABNORMALITIES, by Robert C. King. [nd] 10p. (BNL-1221)

The tolerance of Drosophila melanogaster to salts of some alkali metals was studied. It was concluded that the lithium ion is by far the most toxic, while K^+ is slightly more toxic than Na^+ at high concentrations. The time required for the completion of development for Drosophila fed on a medium containing 0.02 M LiCl is increased two to three-fold. F_1 adult populations consist mainly of males. Characteristic abnormalities are produced involving the male terminalia and wing venation. (auth)

TRACER APPLICATIONS

5965
California Univ., Citrus Experiment Station, Riverside
THE BEHAVIOR OF OCTAMETHYL PYROPHOSPHORAMIDE IN CITRUS PLANTS, by Robert L. Metcalf and Ralph B. March. [nd] 33p. (AECU-2214)

P^{32}-tagged octamethyl pyrophosphoramide (OMPA) was used to study the behavior of this systemic insecticide in lemon and orange plants, and its insecticidal action against the citrus red mite and the greenhouse thrip. Data are presented on tissue distribution of OMPA in the plants and lethal dosage levels for the insects.

5966
Institute of Atomic Research, Iowa State Coll.
THE ACTION OF INVERTASE PREPARATIONS, II, by S. Aronoff and J. S. D. Bacon. Institute of Atomic Research, Iowa State Coll. and Sheffield Univ. (England). [nd] 4p. (AECU-2222)

The formation of intermediate transient by-product compounds by the action of invertase on sucrose is very briefly discussed.

5967
California Univ., Berkeley
CARBONATE AND FATTY ACIDS AS PRECURSORS OF AMINO ACIDS IN CASEIN (thesis), by A. L. Black, M. Kleiber and A. H. Smith. [nd] 8p. (AECU-2224)

Amino acids isolated from casein were used to study the biosynthesis of amino acids in dairy cows after injecting intravenously C^{14}-labeled precursors. We concluded that the microorganisms of the rumen furnish essential amino acids to the cow and that the tissues of the cow synthesize only nonessential amino acids in quantity. From the comparative biochemical aspects this is further evidence for the uniformity which exists in the internal metabolism of mammals. Acetate was the major precursor for non-essential amino acids while CO_2 was the major precursor of amino acids that are considered essential. (auth)

5968
Brookhaven National Lab.
THE TURNOVER OF CARBON IN THE MOUSE AS STUDIED BY THE USE OF TAGGED CARBOHYDRATE, by Robert Steele. [nd] 32p. (BNL-1222)

The excretion in respiratory CO_2, urine, and feces of car-

bon derived from ingested sucrose was measured during the 36-day period following the ingestion of uniformly tagged C^{14} sucrose by young adult C-57 black male mice. The retention of carbon derived from sucrose in each of 28 organs or tissues of the mice under these conditions was measured in ten animals sacrificed at various times during the 36-day period. The specific activity of the respiratory CO_2 of the mice under standard conditions of dosage with uniformly tagged C^{14} sucrose was ascertained and was expressed as an empirical mathematical function of time. It was deduced, after demonstrating that an application of the Zilversmit-Entenman-Fishler precursor-product relationship gives incongruous results for tissue carbon turnover that either (1) the interchange of carbon between the tissue constituents and the pool of CO_2-producing metabolites is less than expected on the basis of the previously observed turnover half times of individual tissue constituents or (2) that a physiological mechanism exists which reduces the movement of carbon from the small molecule metabolites to the tissue constituents when exogenous carbohydrate is being metabolized. If possibility (1) above is correct the general concept of exogenous, as opposed to endogenous, metabolism cannot be attacked by citing the shortness of the turnover times of the major tissue constituents. If possibility (2) is correct there then exists an obvious demarcation of exogenous from endogenous metabolism. (auth)

5969

Brookhaven National Lab.

ROUTES OF ETHANOL FORMATION IN BACTERIA, by Ralph D. DeMoss. [nd] 28p. (BNL-1238)

Studies of the mechanics of ethanol formation by Leuconostoc mesenteroides and Pseudomonas lindneri indicate the existence of anaerobic hexosemonophosphate pathways which differ somewhat from the aerobic systems of yeast and E. coli.

5970

Brookhaven National Lab.

THE VOLUME OF DISTRIBUTION OF RADIOACTIVE CHLORIDE IN DOGS; COMPARISONS WITH SODIUM, BROMIDE AND INULIN SPACES, by J. L. Gamble, Jr. and J. S. Robertson. [nd] 26p. (BNL-1239)

Methods for using either the short-lived Cl^{38} or the long-lived Cl^{36} in conjunction with either Na^{24} or Br^{82} in simultaneous measurements of the volumes of distributions of these substances are described. Results obtained using these methods in dogs indicate that the sodium and chloride spaces are nearly equal at 1 hr after the injection of the isotopes. At 24 hr the chloride space has hardly changed but the sodium space has become about 15% greater. The bromide space is consistently a few per cent larger than the chloride space after the third hour after injection. The inulin space, as determined by the constant infusion technique, was found to be only two-thirds as great as the chloride space at 2½ hr after the start of the infusion and the injection of the isotope. (auth)

5971

Atomic Energy Project, Univ. of Calif., Los Angeles

MECHANISMS IN SKELETAL ACCUMULATION OF IONS, by Norman S. MacDonald, Ralph E. Nusbaum, Florita Ezmirlian, Richard C. Barbera, Patricia Spain, and Donald E. Rounds. Issued Sept. 11, 1952. 13p. (UCLA-222)

The deposition of Sr and of Pb in the femurs of rats as a function of parenteral dosage was studied. A single injection was administered and the content of metal ion determined after 24 hours. Dosages ranged from 0.10 to 75.00 mg of Sr^{++} per 200 g of body weight and from 0.03 to 10.00 mg per 200 g of body weight in the case of Pb^{++}. The uptake indicated that at least two modes of accumulation occurred. The dominant process at low doses was described satisfactorily by an equation of the same form as the Langmuir gas adsorption isotherm. However, an abrupt discontinuity in the graph of the data appeared as the dose was increased. This departure from linearity was interpreted as the point where saturation of the initial mode of deposition was attained. The values of these saturation levels for Sr and Pb were 125 ppm and 60 ppm, respectively. The various compartments in which the cations might conceivably be found in bone were discussed. It was estimated that if the first stage saturation were the result of adsorption or ionic exchange at surfaces of bone salt crystals, the average burden would be approximately 32 atoms of Sr per crystal and 6 per crystal in the case of Pb. However, the combining power of the sulfate present in the organic matrix of bone could equally well account for the binding of the saturation levels of Sr and Pb. (auth)

5972

EXPERIMENTAL STUDY OF THYROID METABOLISM WITH RADIOACTIVE IODINE. J. Gross and Rosalind Pitt-Rivers. Brit. Med. Bull. 8, 136-41(1952).

Studies are described in which I^{131} was used as a tracer to determine the nature of the thyroid hormone, the process involved in the biosynthesis of thyroid hormone from iodide, and the nature of the metabolism of the thyroid hormone.

Note: Although no attempt is made in NSA to cover the field of tracer applications, attention is called to Issue No. 2-3 of the above journal, containing this and other tracer studies.

5973

USE OF RADIOACTIVE PHOSPHORUS FOR THE MEASUREMENT OF RED-CELL AND BLOOD VOLUME. E. B. Reeve. Brit. Med. Bull. 8, 181-6(1952)

Phosphorus^{32} as an agent for the labeling of red blood cells, the preparation of cells labeled with P^{32}, the measurement of P^{32} content of labeled red cells, the dosage of P^{32} required for estimates of red-cell volume, the measurement of red-cell volume with red cells labeled with P^{32}, comparisons of estimates of red-cell volume obtained by different methods, determination of blood volume and a discussion of results obtained by the use of P^{32} for the measurement of red-cell volume and total blood volume are discussed.

5974

STUDY OF BLOOD CIRCULATION WITH RADIOISOTOPES. H. Payling Wright. Brit. Med. Bull. 8, 187-92(1952).

The use of Na^{24} and P^{32} in the direct measurement of blood flow between two defined points, the measurement of build-up of radioactive material at a site remote from that of injection, and the measurement of the rate of removal of radioactive material from an injection site are discussed.

5975

RADIOACTIVE PENICILLIN AND VITAMIN B_{12}. E. Lester Smith. Brit. Med. Bull. 8, 203-5(1952).

The biosynthesis of C^{14}- or S^{35}-labeled penicillin, and tracer studies of the uptake of penicillin by bacteria and the fate of orally administered and injected penicillin are described. The activation of vitamin B_{12} by direct neutron bombardment in an atomic pile, and the biosynthesis of vitamin B_{12} labeled with Co^{60}, P^{32} or C^{14} are discussed. Studies of metabolism using radioactive vitamin B_{12} are reviewed.

5976

PROCUREMENT OF LABELLED COMPOUNDS. W. P. Grove and J. R. Catch. Brit. Med. Bull. 8, 234-45(1952).

The preparation of labeled compounds by the Radiochemical Center at Amersham, England, and procedures for procurement of labeled compounds are discussed. Specific activity and its effect on methods of preparation, chemical and biological methods of synthesis, and considerations of health and cost are reviewed. An appendix includes tables

showing the syntheses of compounds labeled with C^{14}. Included are tables showing primary stages from CO_2, routes from cyanide, routes from acetylene, examples of syntheses via carboxyl-labeled acids, routes from cyanamide, routes from formic acid, and routes from methanol. 141 references.

5977
RAPID DETERMINATION OF I^{131} EXCRETION CURVES FOR HUMAN BEINGS. Frank E. Hoecker and Homer L. Hiebert. Nucleonics 10, No. 9, 56-7(1952) Sept.

A simple apparatus for radiometric assay of urine containing I^{131} is described. The method makes use of a thin-walled, jacketed G-M tube, the jacket of which has a definite volume (3 ml) ensuring volume identity of samples. Flushing the jacket with wash water is accomplished easily.

CHEMISTRY

5978
Argonne National Lab.
PROTACTINIUM (IV) IN SOLUTION, by Sherman Fried and James C. Hindman. July, 1952. Decl. Sept. 18, 1952. 4p. (AECD-3447; ANL-WMM-995)

The absorption spectrum of $PaCl_4$ dissolved in O-free 1N HCl is presented. It is characterized by three maxima in the ultraviolet region, at 2760, 2550, and 2237.5 A. There is no structure in the visible up to 6400 A. The spectrum is remarkably similar to the spectrum of Ce(III) (configuration $4f^1$), suggesting that the assignment of the $5f^1$ configuration to Pa(IV) is not unreasonable. The aqueous solutions are remarkably stable in the absence of air. In this respect the behavior of Pa(IV) is similar to that of U(IV), Np(IV), and Pu(IV), where the kinetics of processes involving the making or breaking of O bonds are appreciably slow.

5979
Texas Agricultural Experiment Station
METHANOLYSIS OF TRIGLYCERIDES BY ANIONIC EXCHANGE RESIN, by Hermann Schlenk and Ralph T. Holman. [nd] 5p. (AECU-2211)

Interesterification of cottonseed, corn, codliver, and coconut oils by methanol, using an anionic exchange resin, Amberlite IRA-400-OH-AG, as catalyst, has been studied. The reaction proceeded rather slowly with most of the fats. It appears certain that the free fatty acids have no role in the course of the interesterification. The amount of resin used, when expressed in equivalents of alkali, is about four times the amount recommended for interesterification by means of Na ethylate of NaOH. A remarkable distinction between the resin catalysis and alkali catalysis is the indifference of the resin catalysis to amounts of water which would interfere with the latter type of reaction.

5980
Lankenau Hospital Research Inst., Philadelphia
OXIDATION OF ALDEHYDES BY MITOCHONDRIA OF RAT TISSUES, by S. S. Walkenstein and Sidney Weinhouse. Lankenau Hospital Research Inst., Philadelphia and Institute for Cancer Research, Philadelphia and Temple Univ. [nd] 17p. (AECU-2218)

In a study of the mechanism of fatty acid activation, the presence was demonstrated in the mitochondria of cells from mammalian and avian liver and kidney of an enzyme capable of oxidizing aliphatic aldehydes to the corresponding acids. Characteristics of the enzyme are discussed.

5981
Brookhaven National Lab.
OXIDATION OF ALCOHOLS BY OXYGEN IN AQUEOUS SOLUTION, INDUCED BY THE HYDROGEN PEROXIDE-FERROUS IRON REACTION. I. REACTION OF ORGANIC RADICALS WITH OXYGEN, by A. I. Medalia. [nd] 43p. (BNL-1223)

Oxidation of alcohols by dissolved oxygen can be initiated by radicals formed by the reaction between hydrogen peroxide and ferrous iron. The course of such reactions has been followed by determining the over-all ratio of hydrogen peroxide reduced to ferrous iron oxidized, by kinetic studies of ferrous iron oxidation, and by direct determination of organic products at low concentrations. In the absence of ferric or cupric ions, the course of the reaction is independent of the concentrations of alcohol, oxygen, and hydrogen peroxide and, with methanol, also nearly independent of the concentrations of acid and of ferrous iron; but with ethanol the results depend somewhat on the latter two concentrations. The chief oxidation product of methanol is formic acid. A hydroxyalkyl hydroperoxide is proposed as an intermediate; it may undergo several reactions, including loss of water to form the carboxylic acid, cleavage to form two free radicals, and (in the case of ethanol) reaction with ferrous iron. The values of Merz and Waters for the ratio of reaction rates of hydroxyl radicals with ferrous iron and with methanol or ethanol have been revised, and a value of the ratio determined for formic acid. (auth)

5982
Brookhaven National Lab.
DISPLACEMENT MECHANISMS IN ENZYMATIC REACTIONS. II. STEREOCHEMICAL CRITERIA OF REACTION MECHANISM, by D. E. Koshland, Jr. [nd] 30p. (BNL-1242)

Examination of the stereochemistry of some enzymatic reactions has led to the hypothesis that two fundamentally different mechanisms are common to enzymatic substitution processes. One of these is a single displacement mechanism in which a direct primary collision between the substrate molecules occurs on the enzyme surface. This leads to inversion of configuration when an asymmetric carbon atom is involved. The other is a double displacement mechanism in which the initial electron-donor, a group on the enzyme surface or in the substrate molecule itself, first reacts with one substrate to form an intermediate of inverted configuration. The second substrate then reacts with the inverted intermediate to form a final product of retained configuration. These mechanisms are shown to be consistent with the enzymatic and chemical evidence. Retention of configuration in enzymatic reactions is also explained in some cases by the fact that the substitution can occur without breaking a bond to the asymmetric atom. (auth)

5983
Brookhaven National Lab.
POLAROGRAPHY OF TELLURIUM (VI), by Elinor Norton, R. W. Stoenner and A. I. Medalia. [nd] 29p. (BNL-1245)

The polarographic reduction of Te VI at the dropping Hg electrode has been investigated in a variety of media. Several media were found to be suitable for the analytical determination of this element. The half-wave potentials and diffusion current constants in these media have been obtained. The reduction of Te VI at the dropping electrode has been found coulometrically to proceed to the −2 state. It was found that Se VI was not reduced at the dropping electrode in any of the media here reported. (auth)

5984
Pennsylvania State Coll. School of Mineral Industries
THE SCREENING OF CATIONS AS A BASIC PRINCIPLE OF INORGANIC CHEMISTRY, by W. A. Weyl. July 1951. 76p. (NP-3994; Technical Report No. 52; U-23258)

An attempt is made to formulate principles of inorganic chemistry in such a manner that the activation energy of a simple chemical reaction can be understood and chemical and physical properties can be correlated. The ionic view-

point of chemical binding of W. Kossel in combination with K. Fajans' rules governing the deformation of ions in electrical fields is used to develop a basis for this approach. It is postulated that the interaction of elements producing anions and cations of noble-gas character leads to stable molecules only under conditions where the cation can be completely surrounded by anions, i.e., when its electrical field can be screened. Chemical reaction is assumed to proceed in the direction which leads to a maximum screening of the dominating cation. The degree of screening received by the cation increases with the polarizability and size of the anion; increasing the size and thermal vibration of the cation decreases the magnitude of screening. These concepts are applied to acidity, nonpolar compounds, homogeneous catalysis, brittleness, and plasticity. The possibility of treating purely chemical (H_2O catalyzing the combination of CO and O) and physical phenomena (formation of H_2O droplets from a supersaturated vapor film) on one basis is believed to be the main advantage of this approach. (NRS abst.)

5985

Pittsburgh Univ.

A STUDY OF ACID CATALYSIS IN KETONE ACYLATIONS, by Bruno H. Perfetti and Robert Levine. Issued Aug. 14, 1952. 12p. (NYO-3380)

Six Lewis acids have been investigated as possible catalysts for the acylation of ketones with anhydrides to give β-diketones. Of these reagents, only two, anhydrous ferric chloride and anhydrous zinc chloride, are satisfactory. In the attempted acylation of acetophenone with acetic anhydride in the presence of aluminum chloride, only dypnone was obtained; while the use of either iodine or anhydrous stannic chloride as the catalyst gave benzoic acid instead of the expected benzoylacetone. (auth)

ANALYTICAL PROCEDURES

5986

Atomic Energy Research Establishment, Harwell, Berks (England)

SQUARE WAVE POLAROGRAPHY. PART I. GENERAL INTRODUCTION, by G. C. Barker and I. Jenkins. May 1952. 15p. (AERE C/R-924)

A method is described for eliminating the undesirable effect of the double-layer capacity current on the sensitivity of an a-c polarograph. A square-wave voltage is used in place of the usual sinusoidal polarizing voltage, and the amplitude of the a-c component of the cell current is measured shortly before each sudden change in the applied voltage. Preliminary results suggest that the method is useful for the detection, at concentrations down to 2×10^{-7} N, of species which are reversibly reduced, and that the sensitivity of the method is not greatly influenced by the presence of large concentrations of ions which produce interfering waves on the ordinary polarogram. Brief mention is made of an extension of the method which permits the detection of certain metallic species at concentrations of 10^{-9} M. (auth)

5987

Brookhaven National Lab.

THE CATALYTIC EFFECT OF MOLYBDATE ON THE HYDROLYSIS OF ORGANIC PHOSPHATES, by Leo Lutwak and Jacob Sacks. [nd] 12p. (BNL-1224)

The catalysis of the hydrolysis of organic phosphates by molybdate has been shown to be accompanied by the formation of molybdate–organic phosphate complexes. The absorption spectra of these complexes are indistinguishable from that of reduced phosphomolybdate. Calculations of the kinetics based on the color formed by the addition of the Fiske-SubbaRow reagents for inorganic phosphate lack significance because part of the color is due to the molybdate–organic phosphate complex. (auth)

5988

Brookhaven National Lab.

PREPARATION OF SERUM LIPID EXTRACTS FREE OF INORGANIC PHOSPHATE, by Donald D. Van Slyke and Jacob Sacks. [nd] 8p. (BNL-1235)

The results of test precipitations indicate that in serum analyses all the phosphorus extracted by alcohol-ether by Bloor's method, either directly from plasma or from the protein-lipid precipitates formed with iron or zinc hydroxides, can be assumed to be organic. Such assumption cannot be made for the phosphorus extracted from protein-lipid precipitates formed with tungstic acid. (auth)

5989

Centre de Physique Nucléaire de L'Université Libre de Bruxelles

EMPLOI DE L'UX_1 COMME RADIOTRACEUR DANS LE DOSAGE DU THORIUM. [USE OF $UX_1(Th^{234})$ AS RADIOTRACER IN THE DETERMINATION OF THORIUM], by H. von Buttlar and N. Isaac. July 1952. 8p. (NP-4067; Bulletin Note No. 36)

A preliminary study on the determination of Th in monazite, containing a few parts per 1000 of Th, by use of $UX_1(Th^{234})$ tracer is reported. Th and the rare earths are precipitated as oxalates by addition of warm oxalic acid and then taken up by concentrated H_2SO_4. The sulfates are removed by precipitation with NaOH after Ce^{+4} is reduced to Ce^{+3} by H_2O_2. HNO_3 redissolves the hydroxides, and Th is separated from the rare earths by a double precipitation at pH 5.7 with NH_4OH. ThO_2 is precipitated, dried, and calcined. Radiometric analysis of the Th^{234} content indicates that the yield of Th is about 84.5 ± 2%.

5990

Department of Mines and Technical Surveys (Canada)

THE AMPEROMETRIC TITRATION OF FLUORIDE WITH THORIUM NITRATE, by A. Hitchen. Aug. 8, 1952. 7p. (NP-4106; TR-102/52)

A method is described for determining fluorides by amperometric titration with thorium nitrate. The fluorine is separated from interfering elements by distillation as fluosilicic acid from a perchloric acid solution. (auth)

5991

Ames Lab.

SPECTROPHOTOMETRIC DETERMINATION OF ALUMINUM IN THORIUM; EXTRACTION OF ALUMINUM WITH 8-QUINOLINOL IN CHLOROFORM, by D. W. Margerum, Wilbur Sprain, and Charles V. Banks. Sept. 1, 1952. 20p. (ISC-260; LR-103)

Work was undertaken to devise a rapid and sensitive chemical method for the determination of trace quantities of aluminum in thorium. The developed method utilizes a spectrophotometric determination of aluminum following an extraction with a solution of 8-quinolinol in chloroform. Extraction of thorium is prevented by the use of either 4-sulfobenzenearsonic acid or concentrated acetate buffer as the masking agent. The absorption spectra for a 1% solution of 8-quinolinol in chloroform containing acetic acid is given. (auth)

5992

ISOTOPIC METHOD FOR DIRECT DETERMINATION OF OXYGEN IN FLUOROCARBON DERIVATIVES. A. D. Kirshenbaum, A. G. Streng, and A. V. Grosse. Anal. Chem. 24, 1361-2(1952) Aug.

Fluorocarbon compounds are very stable to thermal decomposition and hydrogenation. The elementary isotopic method can, however, with very little modification, be used to determine oxygen in fluorocarbon derivatives with satisfactory results, as complete decomposition is not necessary with this method. The method consists in the addition of known amounts of O^{18} to a known weight of the substance to be analyzed and determination of the isotope ratio in any

suitable O compound with a mass spectrometer after high-temperature equilibration.

5993
PAPER CHROMATOGRAPHIC ANALYSIS OF ALUMINIUM ALLOYS. G. Venturello and A. M. Ghe. Anal. Chim. Acta. 7, 268-73(1952) Sept. (In English)

Qualitative and quantitative determination of Cu, Zn, Fe, Mn, Pb, etc., in light Al alloys by the use of a paper-chromatographic technique has been proved feasible.

5994
AMPEROMETRIC DETERMINATION OF FLUORIDE. C. R. Castor and J. H. Saylor. Anal. Chem. 24, 1369-71(1952) Aug.

The method described depends on the decrease in diffusion current of an Al-dye complex in the presence of fluoride ion with a corresponding increase in the diffusion current of the free dye. It was found that the low solubility of Pontachrome Violet SW made it impractical for use in the amperometric titrations. However, investigation showed that Superchrome Garnet Y (Colour Index 168), which is the Na salt of 5-sulfo-2-hydroxybenzeneazoresorcinol, has similar polarographic characteristics and a much greater solubility. The fluoride concentration present in the final polarographic solution should be between 2 and 8 mg of fluoride ion per 100 ml. By selection of a sample weight between 0.1 and 1.0 g and without exceeding a dilution factor of 10, the method may be used over a range of 0.2 to 80% fluoride.

5995
ANALYTICAL CHEMISTRY OF THORIUM. PART X. AMMONIUM FUROATE (PYROMUCJATE) AND SODIUM SULPHANILATE. D. Lakshminarayana and Bh. S. V. Raghava Rao. J. Indian Chem. Soc. 28, 551-4(1951) Oct.

Two new reagents, ammonium furoate and Na sulfanilate, have been investigated and recommended for the estimation and separation of Th from the rare earths. The first functions in the pH above 2.0, estimates as little as 2.2 mg of ThO_2, and frees in one precipitation Th from 50-fold excess of cerite earth oxides. The second functions in the pH above 2.3, estimates as small as 1 mg of ThO_2, and frees Th similarly from a 100-fold excess of cerite earth oxides. Both the reagents have been used to estimate Th in monazite. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5996
Institute for the Study of Rate Processes, Univ. of Utah
SOME FACTORS IN THE GROWTH OF CRYSTALS, by Dan McLachlan, Jr., Allan Carlson, Carl J. Christensen and Alan King. Jan. 1, 1951. 62p. (NP-4041; Technical Report No. 9; U-22139)

The following are considered: (1) a mathematical expression for extending the Donnay-Harker law which predicts the dominant faces in normal grown crystals; (2) the effect of solvent in the normal growth of crystals grown from solutions and factors resulting in defects and growth anomalies; (3) calculations of the flow of material, heat, or electrons into dendritic crystal regions by the use of conformal mapping; (4) the application of uneven loading statistics and crystal thermal wave loading to the growth of snow crystals; and (5) the growth of crystals and the voids within crystals by chance. (NRS abst.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

5997
National Bureau of Standards
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS; ANNUAL BIBLIOGRAPHY - 1949, by L. M. Brown, J. M. Goldstein, and C. W. Beckett. Aug. 1, 1952. 74p. (NBS-1721)

A bibliography of published research on the isotopes of hydrogen and their compounds has been compiled from Chemical Abstracts, British Abstracts, and Physics Abstracts for the year 1949. Each entry in the bibliography is listed alphabetically according to its leading author and contains, in addition to its title and literature reference, a subject code symbol designating its content. The bibliography is supplemented by both a compound and a subject index. The arrangement of the bibliography parallels that of a similar bibliography compiled by Kimball for the period 1932 to 1945, inclusive. (auth)

5998
CATALYSIS ON EVAPORATED METAL FILMS. I. THE EFFICIENCY OF DIFFERENT METALS FOR THE REACTION BETWEEN AMMONIA AND DEUTERIUM. C. Kemball. Proc. Roy. Soc. (London) A214, 413-26(1952) Sept. 23.

The exchange reaction between NH_3 and D_2 has been followed on evaporated films of Pt, Rh, Pd, Ni, W, Fe, Cu, and Ag by means of a mass spectrometer. In all cases the initial product was deuteroammonia (NH_2D), and the other deutero ammonias were formed by successive reactions. Despite a considerable variation in the catalytic activity from metal to metal the relative concentrations of the deuteroammonias formed throughout each reaction were identical in every case, and differential equations are developed to show that this is a consequence of the fact that only one H atom is exchanged at a time. The energies of activation varied from 5.2 kcal/mole for Pt to 14.1 kcal/mole for Ag and there is a correlation between the energies of activation and the work functions of the metals. The frequency factors were almost identical on all the metals except W. Possible mechanisms for the reaction are discussed. The catalysis of the exchange reaction by films of oxidized Cu, W, Ni, and Zn and by Zn oxide was also investigated. (auth)

5999
EMISSION SPECTRUM OF AMMONIA AND HEAVY AMMONIA; $^1\Pi \rightarrow {}^1\Delta$ TRANSITION OF NH AND ND RADICALS. René Florent and Sydney Leach. J. phys. radium 13, 377-85(1952) July- Aug.- Sept. (In French)

The (1,0), (0,0), and (0,1) bands of the $^1\Pi \rightarrow {}^1\Delta$ transitions of the NH and ND radicals have been analyzed. Rotation constants of the two states have been calculated, and the simple isotopic relations have been verified for the rotation. Vibration constants have been calculated by a isotopic displacement method. The separation of the $^1\Delta$ and $^3\Sigma^-$ states is of the order of 1.2 ev.

FLUORINE AND FLUORINE COMPOUNDS

6000
Carbide and Carbon Chemicals Co. (K-25)
THE STRUCTURES OF THE INTERHALOGEN COMPOUNDS. I. CHLORINE TRIFLUORIDE AT −120°C, by R. D. Burbank and F. N. Bensey. Issued Sept. 5, 1952. 22p. (K-939)

A technique has been developed for handling the extremely reactive interhalogen compounds which makes it possible to investigate their structures by x-ray diffraction at low temperatures. As the first step in a program of study of the interhalogen group the crystal structure of ClF_3 has been determined at −120°C. The ClF_3 molecule is planar with the point group symmetry mm. The Cl atom is bonded to one F atom at 1.621 A and to two F atoms at 1.716 A. The F-Cl-F bond angle is 86° 59'. A report of a parallel investigation of the vapor phase by microwave spectroscopy is being prepared. The molecular configuration is identical in the two cases. (auth)

6001
MOLECULAR ORDER IN n-HEPTANE AND n-PERFLUOROHEPTANE. J. H. Hildebrand and G. J. Rotariu. J. Am.

Chem. Soc. 74, 4455-6(1952) Sept. 5.

Molecules of n-C_7F_{16} should pack in a more orderly, parallel array in the liquid state than should n-C_7H_{16}. Evidence for this was sought in a difference between the entropies of vaporization at equal gas volumes and at equal vapor/liquid volume ratios. The respective excess entropies for the F compound were 1.6 and 2.9 E. U.

6002

THE REACTION OF SILVER n-PERFLUOROBUTYRATE WITH n-PERFLUOROPROPYL IODIDE AND WITH 1,2-DIBROMO-1-CHLOROTRIFLUOROETHANE. Murray Hauptschein and Aristid V. Grosse. J. Am. Chem. Soc. 74, 4454-5(1952) Sept. 5.

Several attempts were made to synthesize perfluorinated esters by the reaction of Ag salts of perfluoro-fatty acids with perfluoroalkyl iodides, but without success. In contrast to the ease of formation of esters by treating perfluoro-Ag salts with n-alkyl iodides and diiodides, the attempted preparation of n-perfluoropropyl-n-perfluorobutyrate by the reaction of silver n-perfluorobutyrate with n-perfluoropropyl iodide at 275 to 335°C, in the absence of solvents, resulted in the formation of n-perfluorohexane, CO_2, and AgI according to the equation $CF_3CF_2CF_2I + CF_3CF_2CF_2CO_2Ag \rightarrow$ n-$C_6F_{14} + CO_2 + AgI$. These results suggest a free radical mechanism with formation of C_3F_7 and C_3F_7COO. At the high temperature of the reaction, direct combination does not take place. The latter radical loses CO_2, and the coupling product, $C_3F_7-C_3F_7$, is formed exclusively.

6003

[UNIT PROCESSES REVIEW]; HALOGENATION. Ogden R. Pierce and Earl T. McBee. Ind. Eng. Chem. 44, 2015-20 (1952) Sept.

Progress during 1951 in fluorination of hydrocarbons and olefins, polymerization of fluorocarbons, properties of oxygenated fluorine compounds, and preparation of S- and N-containing fluorine compounds is reviewed, together with progress on chlorination, bromination, and iodination. 130 references.

6004

TEFLON TETRAFLUOROETHYLENE RESIN DISPERSION; EXTRUSION PROPERTIES OF LUBRICATED RESIN FROM COAGULATED DISPERSION. John F. Lontz, Joseph A. Jaffe, Lester E. Robb, and William B. Happoldt, Jr. Ind. Eng. Chem. 44, 1805-10(1952) Aug.

In studying the properties of the aqueous dispersions of Teflon tetrafluoroethylene resin, it was discovered that the colloidal form of polymer forms a polymer-in-oil composition when coagulated in the presence of organic lubricants. Further work indicated that these polymer-in-oil compositions could also be prepared by mixing the dry coagulated polymer with a variety of organic compounds, some of which act as lubricants. These compositions can be extruded into various forms at room temperature at rates appreciably higher than those attainable by the high-temperature extrusion of the nonlubricated polymer.

6005

TEFLON TETRAFLUOROETHYLENE RESIN DISPERSION; A NEW AQUEOUS COLLOIDAL DISPERSION OF POLYTETRAFLUOROETHYLENE. John F. Lontz and William B. Happoldt, Jr. Ind. Eng. Chem. 44, 1800-5(1952) Aug.

As polytetrafluoroethylene has an extraordinarily high melt viscosity and lacks the flow characteristics of thermoplastics when heated above the softening point, the methods of fabricating the granular form of polymer are somewhat limited. On the other hand, the aqueous dispersion is especially suited to forming films, to coating and impregnating applications, and to preparing mixtures with a variety of fillers such as carbon, silica, and clay for molding purposes. This paper describes the general dispersion properties and film-forming characteristics of the dispersion form of polymer.

GRAPHITE

6006

Centre de Physique Nucléaire de L'Université Libre de Bruxelles

PREPARATION DE GRAPHITE NUCLEAIREMENT PUR. [PREPARATION OF GRAPHITE OF HIGH NUCLEAR PURITY], by W. L. De Keyser and R. Cypres. June 1952. 37p. (NP-4066; Bulletin Note No. 35)

With a view toward the elaboration of a new method of preparation of high purity graphite for use as a neutron moderator in nuclear reactors, various gaseous hydrocarbons were subjected to thermal decomposition and a graphitic gas coke were obtained. The formation of this coke is independent of the nature of the refractory surface upon which it deposits and depends upon the cracking temperature. Samples of different types of carbons produced were examined by reflection through the polarizing microscope and also by x-ray diffraction. A mechanism of formation of the graphitic coke is suggested. The study of the chemical purity of the carbons obtained and particularly their boron content was made by colorimetric analysis and optical emission spectrography. The boron content of the carbons produced did not exceed 0.2 ppm. The obtainment of a graphitic coke by thermal decomposition of a gas and its further transformation at high temperature into graphite reveals general information as to the mechanism of graphite formation and the role played by mineral compounds of the ashes in the graphitication of carbons. Finally, some practical results obtained from the use of this gas coke in the manufacture of molded pieces are indicated. (auth)

MOLECULAR STRUCTURE

6007

Ames Lab.

MAGNETIC AND SPECTROPHOTOMETRIC STUDIES OF NICKEL (II) COMPLEXES WITH SOME VIC-DIOXIMES, by Charles V. Banks and Roy W. Vander Haar. July 15, 1952. 26p. (ISC-255)

The crystalline complexes of nickel(II) with α-benzildioxime, 2,3-butanedionedioxime, 1,2-cycloheptanedionedioxime, 1,2-cyclohexanedionedioxime and α-furildioxime have been found to be diamagnetic, and thus are all to be considered examples of the normal square coplanar configuration. The nickel(II) compounds exhibit varying amounts of reaction with organic bases to form paramagnetic complexes. Magnetic and spectrophotometric studies of this effect show that, of the five compounds considered, 1,2-bis(α-furildioxime-N,N')nickel(II) is the least stable toward reaction with pridine or n-butylamine. Speculations as to the nature of the reactions are presented. (auth)

RADIATION EFFECTS

6008

Carbide and Carbon Chemicals Co. (Y-12)

THE EFFECT OF α-, β-, γ-, AND X-RAYS ON ORGANIC COMPOUNDS; A LITERATURE SEARCH, by Frances Sachs. Aug. 18, 1952. 92p. (Y-904)

This bibliography was compiled from references found in Chemical Abstracts 20, (1926) through 44, (1950) and Nuclear Science Abstracts 1, (1948) through 6, No. 6(1952).

6009

THE IRRADIATION-INDUCED AUTOXIDATION OF LINOLEIC ACID. James F. Mead. Science 115, 470-2(1952) Apr.

Investigation of the effect of radiation on linoleic acid showed the dependence of ionic yield on concentration of

linoleate and dose rate. Irradiation rate affected the concentration of product during and after irradiation. Autoxidation during irradiation produced small but significant changes. Removal of O followed by addition of N prior to irradiation markedly reduced ionic yield when compared with samples irradiated in the presence of air. Addition of cysteine prior to irradiation was found to reduce the ionic yield. No attempt was made to interpret the kinetics of the irradiation-initiated reaction.

RARE EARTHS AND RARE-EARTH COMPOUNDS

6010

THE M_V ABSORPTION EDGES OF Tm AND Er AND THE ORIGIN OF THE Er M_V ABSORPTION LINES. P. A. Lee, E. A. Stewardson, and J. E. Wilson. Proc. Phys. Soc. (London) A65, 668-9(1952) Aug. 1.

The M_V x-ray absorption edges of Tm and Er are estimated, and a reconciliation of the conflicting results of various authors for this absorption region is attempted.

6011

ATTACK ON METALLIC CARBIDES BY WATER VAPOR AND ORGANIC VAPORS. Jacques de Villelume. Ann. chim. (12) 7, 265-310(1952) May-June. (In French)

A doctoral thesis reports experiments on the products and mechanism of attack on Al, Ca, La, Ce, rare-earth, Fe, and Mn carbides by water vapor and various alcohol and other organic vapors.

SEPARATION PROCEDURES

6012

Wisconsin Univ.

THE ION-EXCHANGE SEPARATION OF ISOMERIC DINITROTETRAMMINECOBALT-(III) IONS, by Edward L. King and Robert R. Walters. [nd] 3p. (AECU-2219)

The separation of isomers of dinitrotetraamminecobalt(III) ions by ion exchange is discussed.

SYNTHESES

6013

California Univ., Berkeley Coll. of Agriculture

BIOSYNTHESIS OF C^{14}-LABELED PROTEIN AND AMINO ACIDS WITH RHODOSPIRILLUM RUBRUM, by H. Tarver, M. Tabachnick, E. S. Canellakis, D. Fraser and H. A. Barker. [nd] 15p. (AECU-2216)

Conditions are described for the culture of Rhodospirillum rubrum in media containing labeled carbon dioxide and unlabeled alcohol as sole carbon sources such that protein and amino acids of high specific activity are produced. As much as 40% of the radioactive carbon employed is found in the acid hydrolysate of the washed bacteria. Of this amount most is in the form of labeled amino acids, particularly in the dicarboxylic acids, glycine, alanine, and in a mixture of phenylalanine and arginine. (auth)

6014

Ames Lab.

REACTION OF THE SODIUM SALT OF 2-HYDROXYIMINOCYCLOHEXANONE WITH HYDROXYLAMMONIUM CHLORIDE, by Charles V. Banks and James L. Pflasterer. July 12, 1952. 17p. (ISC-264)

A new compound has been prepared by the oximation of the sodium salt of 2-hydroxyiminocyclohexanone in an aqueous solution containing calcium carbonate. A structural formula is proposed and the effect of pH on the absorption spectra is given. The name given to the oximation product is 2,3,4-triazabicyclo-[3.4.0]-3-hydroxy-1,4-nonadiene hemihydrate.

6015

NYO-3069

Pittsburgh Univ.

PREPARATION OF BENZISOXAZOLES BY OXIDATIVE RING CLOSURE, by Henry Freiser and Joseph L. Walter. Issued Aug. 11, 1952. 8p. (NYO-3069)

One mole of 2-(o-hydroxyphenyl)-benzimidazole was found to take up 3 moles of Br, only 2 of which were introduced into the molecule. It is postulated that the third mole oxidized the compound to yield a ring-closed dibrominated benzimidazo-benzisoxazole. Salicylamide and anthranilic acid reacted similarly. This reaction is suggested as a novel method of formation of benzisoxazoles.

6016

PREPARATION OF RADIOACTIVE O,O-DIETHYL-O-(p-NITROPHENYL)-MONOTHIOPHOSPHATE-P^{32}; ITS UPTAKE AND METABOLISM IN THE INSECT BODY. Siegfried Lockau and Manfred Lüdicke. Z. Naturforsch. b7, 389-97 (1952) July. (In German)

URANIUM AND URANIUM COMPOUNDS

6017

Argonne National Lab.

THE STABILITY OF MOLECULAR ADDITION COMPOUNDS. I. URANYL NITRATE, by H. M. Feder, L. E. Ross and R. C. Vogel. Mar. 1952. 18p. (ANL-4868)

The stabilities of molecular addition compounds in an inert solvent formed from uranyl nitrate and various organic addenda have been investigated. Formation constants for addenda were determined by a solubility method using the system solid uranyl nitrate dihydrate in equilibrium with the addenda dissolved in an inert organic solvent. Of the cases studied the predominant species in solution were either the 1:1 or the 1:2 molecular addition compound. It is suggested that increased stability of the molecular addition compound is due to greater available electron density of the addend. It is shown that variations in stabilities with changes in structure of the addend generally correlate with the predictable changes in the available electron density. (auth)

WASTE DISPOSAL

6018

Kellex Corp.

SUMMARY PROGRESS REPORT [FOR] MAY 1951 [ON] DEVELOPMENT OF LABORATORY WASTE DISPOSAL UNIT; JOB 24-A. June 15, 1951. 8p. (KLX-1349)

The first prototype waste disposal unit was completed and radiation measurements at several millicurie loadings were made. The determination of the amount of radiation from the waste disposal unit was made by feeding the cartridge with a solution of unseparated fission products up to a loading of 10 mc. Results are tabulated. Design and performance of a commercially available laboratory-scale ion-exchange unit is studied. Results of column tests with feeds of individual radioisotopes are presented.

ENGINEERING

6019

Atomic Energy Research Establishment, Harwell, Berks (England)

A STRAIGHT WIRE HEATER FOR VACUUM EVAPORATION, by J. G. S. Biram. June 5, 1952. 5p. (AERE EL/R-952)

Construction of a simple resistance heater for use in vacuum evaporation is described. Its principal applications are to the evaporation of reactive and/or high-melting-point materials, to the coating of thin plastic targets, to the coating of inner surfaces of tubes, and to evaporation of heavier metals whose wetting forces are small.

6020
New York State Coll. of Ceramics, Alfred Univ.
HIGH TEMPERATURE RESISTANCE THERMOMETER TEMPERATURE CONTROLLER, by W. B. Crandall and P. M. Hackett. New York State Coll. of Ceramics, Alfred Univ. and Niagara Electron Labs. June 15, 1952. 13p. (NP-4009; U-23462)

An automatic temperature controller was constructed for use in a furnace in which the specimen can be loaded and unloaded in an atmosphere other than air. The controller, whose sensing element surrounds the temperature and atmosphere control zone, summarizes temperature over a region and maintains temperature with small fluctuations over long periods. The components are: a sensing element, Wheatstone bridge unit, galvanometer with capacitor flag, Thermocap relay, and regulating reactor and power contactors. In the operation of the control circuit, the temperature is assumed to be at a set point within the neutral zone of control; one contactor is closed, shorting out the reactance to allow enough current to satisfy normal demand. At lower temperatures, the resistance of the sensing element is lowered, the Wheatstone bridge is unbalanced, the galvanometer is deflected to produce less capacity in the Thermocap circuit, and the second contactor is closed to short out further reactance and increase the heat. At higher temperatures, the control coil senses the rise and increases its resistance; this causes the control system to operate in reverse with one contactor closed. If the rise goes too far, the galvanometer deflects to increase capacity, the Thermocap opens the first contact, the full reactance is placed in series with the transformer, and heat is decreased. Temperatures are maintained with ±1°C fluctuation within a 200 to 1500°C range. (NRS abst.)

6021
DEVELOPMENT OF ELECTRODES FOR WELDING OF AUSTENITIC STEELS FOR HIGH-PRESSURE VESSELS. E. Kauhausen and H. A. Vogels. Schweissen u. Schneiden 4, 35-40(1952) Feb. (In German)

A ferrite-free austenitic electrode is discussed with which thick plates can be welded free from heat stresses and microcracks. The quality factors of the joint welds regarding hot strength, intercrystalline corrosion resistance, and absence of embrittlement are equal to those of the base material to be welded. (auth)

AEROSOLS

6022
ELECTRICAL FILTER FOR OBTAINING SAMPLES OF ATMOSPHERIC DUST. V. F. Litvinov, N. N. Litvinova, and M. M. Dabakh'yan. Gigiena i Sanit., 22-6(1951) Oct. (In Russian)

A portable electrostatic (Cottrell precipitation) devise for obtaining samples of dust for microscopic and chemical analysis is described. Hundredths of a milligram of dust in 1 m^3 of air can be determined accurately with the new precipitator.

6023
GRAVIMETRIC DETERMINATION OF AIR DUST BY THE METHOD OF MEMBRANE FILTERS. Ya. B. Reznik. Gigiena i Sanit., 28-32(1951) Oct. (In Russian)

The newly developed method described permits gravimetric determination and a dust count (determination of the degree of dispersion) on the same sample or on two samples taken simultaneously. The shortcomings of Owens counters caused by hygroscopicity of filters and selective capture of a definite range of particle sizes are avoided.

HEAT TRANSFER AND FLUID FLOW

6024
BOUNDARY LAYERS ON CYLINDRICAL BODIES IN NONSTATIONARY TRANSVERSE MOTION. Walter Wuest. Z. angew. Math. u. Mech. 32, 172-8(1952) June. (In German)

A very simple three-dimensional nonstationary problem of laminar boundary-layer currents is given by flow against cylindrical bodies with time-dependent axial movement. A general method of solution is deduced and discussed for several numerical examples.

6025
ON CONNECTION OF GENERALIZED INTEGRAL RATIOS WITH THE HYDRODYNAMIC THEORY OF HEAT EXCHANGE AND ON ITS APPLICATION TO CALCULATION OF HEAT EXCHANGE UNDER CONDITIONS OF THE EXTERNAL PROBLEM. L. I. Kudryashev. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, 1682-8(1951) Nov. (In Russian)

The relation of generalized integral ratios for hydrodynamic and thermal boundary layers in cases of turbulent or laminar motions to the hydrodynamic theory of heat exchange is established. Use of this relation permits calculation of heat-exchange coefficients in cases of flow around plane plates with any law of velocity distribution and excessive temperatures in the boundary layer.

6026
INVESTIGATION OF PROCESS OF TURBULENT MIXING IN FLUID FLOW. V. A. Baum. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, 201-16(1952) Feb. (In Russian)

Turbulent mixing of a stream of water with a stream of aqueous $Na_2S_2O_3$ in tubes of square cross section and lengths of 12 and 25 diameters was investigated. A partial differential equation of the process is given, and the coefficient of turbulent mixing is expressed empirically in terms of Reynolds number.

6027
TURBULENT DIFFUSION AND EROSION. Richard W. Davies. J. Applied Phys. 23, 941-8(1952) Sept.

A new theory of turbulent diffusion is developed so as to describe the dynamics of particulate matter in fluid suspensions. In order that the statistical description be consistent with force equation dynamics of sedimentation, a new diffusion equation is derived from the postulates of a past-future stochastic process. A steady-state suspension of particles in a turbulent stream is treated like an atmosphere. Dimensional arguments are used to retain the most relevant physical entities in a linear theory. It is shown that the bed load and mid-stream suspension of a muddy stream cannot be considered separately. Some experiments are discussed in this connection. A qualitative theory of sand rippling is explained in terms of the instability of a flat sandy bottom under certain turbulence conditions. A singular perturbation method is employed to obtain an asymptotic expansion of the solution on the equilibrium equation. Assumptions are discussed and criticized. The advantage of the theory is that all statistical coefficients are averages of familiar dynamical quantities. (auth)

6028
ON DISTRIBUTION OF VELOCITIES DURING TURBULENT FLOW OF LIQUID IN PIPES. A. D. Al'tshul. Gidrotekh. Stroit., 33-5(1951) Jan. (In Russian)

The Prandtl-Carman theory of turbulent motion is criticized as unsubstantiated and based on assumptions contradicting experimental data. A new hypothesis on the proportionality of length of stirring path to velocity under conditions of laminar motion is proposed. From this hypothesis is deduced a formula for distribution of velocities of turbulent motion in round pipes. The equations of Prandtl and Carman are considered as justified only near pipe walls.

6029
ON THE COEFFICIENT OF HYDRAULIC RESISTANCE DURING TURBULENT FLOW OF LIQUID IN SMOOTH PIPES. O. S. Berlyand. Gidrotekh. Stroit., 35-6(1951) Jan. (In Russian)

The equation for the coefficient of resistance obtained from the logarithmic law of velocity distribution is demonstrated to be justified for Al'tshul's new generalized law (Gidrotekh. Stroit., 33-5(1951)). This is explained by the fact that certain variations of velocities in the flow core have almost no effect on the value of hydraulic resistance, which is determined chiefly by near-wall conditions subordinate to the logarithmic law.

6030
FLOW OF COMPRESSED AIR IN INCLINED PIPELINES. A. E. Smoldyrev. Doklady Akad. Nauk S.S.S.R. 81, 165-6 (1951) Nov. (In Russian)

The air motion (descending and ascending) in inclined pipelines used in pneumatic installations for conveying crushed rocks is analyzed, and formulas for calculating air consumption are developed. A numerical example illustrates application of equations of compressed air motion.

6031
THE TEMPERATURE DEPENDENCE OF THE VISCOSITY OF LIQUIDS. F. Gutmann and L. M. Simmons. J. Applied Phys. 23, 977-8(1952) Sept.

The equation $\log\eta = A + B/(T + C)$ is obtained as a simple modification of Andrade's viscosity equation by treating the activation energy as a function of temperature, A, B, and C being free parameters. This is shown statistically to express adequately the temperature dependence of viscosity over substantial ranges of temperature for all the liquids examined, *viz.*, n-heptane; n-nonane; n-undecane; n-tridecane; n-heptadecane; benzene; viscous mineral oil; ethanol; 1,2-dibromopropane; water; mercury; molten gallium; potassium; sodium; sodium nitrate; silver bromide; lead chloride; bromine; 98 to 100% sulfuric acid. (auth)

6032
HEAT FLOW IN AN INFINITE MEDIUM HEATED BY A SPHERE. H. Goldenberg and C. J. Tranter. Brit. J. Applied Phys. 3, 296-8(1952) Sept.

A solution is given of the heat conduction problem in which a sphere generating heat at a constant rate is embedded in an infinite medium of different thermal properties. The solution is of use in a consideration of the disinfestation and sterilization of biological materials by differential heating due to the application of h-f fields. Typical curves are given showing the transient temperature at the center of the sphere for various ratios of the physical constants involved. (auth)

6033
INVESTIGATION OF ANNULAR LIQUID FLOW WITH COCURRENT AIR FLOW IN HORIZONTAL TUBES. A. E. Abramson. J. Applied Mechanics 19, 267-74(1952) Sept.

Visual observations and flow analysis were made of annular liquid flow with cocurrent air flow in horizontal tubes. The effect of liquid properties and air-stream conditions on the characteristics of the liquid flow were observed. The results are presented in form of shadowgraph pictures of the liquid flow. Analysis of the flow system related the characteristics of the liquid flow to the flow conditions. (auth)

MATERIALS TESTING

6034
Armour Research Foundation
V-NOTCH CHARPY FRACTURE TRANSITIONS OF 0.40% CARBON MEDIUM ALLOY TEMPERED MARTENSITE; REPORT NO. 36 (TECHNICAL REPORT), by M. Baeyertz, E. S. Bumps, and J. P. Sheehan. June 16, 1952. 34p. (NP-3988; Report No. 36; U-23294)

Impact fractures of tempered martensite with Rockwell C hardnesses of 52 to 27 at 400° to 1200°F were examined microscopically to determine the structural features responsible for the observed transition energy and fracture changes. Various tempering treatments produced brittleness in the temperature ranges from 400 to 600°F (I) and from 1000 to 1200°F (II). With respect to prior austenite grain boundaries, the fracture path proceeded from transgranular to intergranular to transgranular for brittle-fracture specimens tempered below, within, and above temperature range I, respectively. The disappearance of the intergranular or transgranular facets from the fracture roughly coincided with the attainment of the maximum energy in the energy-testing temperature relation. Above the transition, the ductile fractures were transgranular irrespective of the nature of the fracture below or within the transition. The extent of deformed metal in the broken specimens appeared to be a function of the hardness of the tempered martensite. Apparently caution is required in comparing martensites by V-notch Charpy fracture transitions unless the tempered structures are of similar hardness. (NRS abst.)

6035
New Jersey Ceramic Research Station, Rutgers Univ.
TECHNICAL REPORT NO. 4 [ON] A METHOD SUITABLE FOR MEASUREMENT OF VISCOSITIES AT HIGH TEMPERATURE. Aug. 1, 1952. 14p. (NP-4013; Technical Report No. 4; U-23343)

A method of measuring viscosities at high temperatures is proposed by which the viscosity/density ratios of the liquid are deduced from the motion resulting from two torques: (1) a torque (whose magnitude varies sinusoidally with time at a controllable frequency) applied to the liquid-filled cylinder and (2) a retarding torque exerted by the liquid. Two approaches are discussed for calculating the viscosity; one does not depend on phase measurements and one involves measurement of the phase difference between the actual oscillations and the applied torque. The latter is considered more advantageous because it provides greater freedom in the choice of frequency, but more apparatus may be needed. Devices for applying the torque and measuring the amplitude and phase of the applied torque and the resultant motion are described. The sources of error (friction of the suspension and end effects of the crucible) are discussed. (NRS abst.)

VACUUM SYSTEMS

6036
National Bureau of Standards
THERMALLY OPERATED GLASS VALVE TO PROVIDE VERY SMALL CONTROLLED GAS FLOW RATES, by Ralph Forman. June 27, 1952. 14p. (NBS-1762)

A new-type vacuum valve has been developed in which the sealing action is dependent on the degree of contact of optically polished glass surfaces. The control of the valve is dependent on the differential expansion of valve parts brought about by heating. The use of a valve of this type may be advantageous for either or both of two reasons: it is not necessary to use grease on the sealing surfaces, and the rate of flow of gas through the valve can be quite accurately controlled over an extensive range of leakage rates.

WASTE DISPOSAL

6037
REMOVAL OF DETRIMENTAL FLUORINE COMPOUNDS FROM THE ATMOSPHERE IN ENAMELING PLANTS. A. W. Bruins. Ber. deut. keram. Ges. 29, 52-5(1952).

The following abstract appeared in Ceram. Abstracts, 138(1952) Aug. and is reproduced here in its entirety.

The F content of waste gases from the stack (calculated as HF) depends chiefly on the nature of the raw materials used in the enamel batches. Fluorspar produces a minimum amount and Na_2SiF_6 a maximum amount of F-containing ingredients in the gases (HF, H_2SiF_6, and SiF_4); cryolite is intermediate in this respect. The gases chiefly contain

liquid droplets in suspension accompanied by F-containing dust particles, with a distinct enrichment of F in the liquid phase. For the analytical determination of F in waste gases the best method is volumetric reactions with thorium nitrate solution. The gases are efficiently cleaned of detrimental fluorides by either a Cottrell or a Stroeder-Lurgi absorption apparatus. New experiments with the Peabody gas scrubber and its construction are described in detail. Gases with an initial HF content of 0.5% are cleaned to a residual amount of 0.01 to 0.02% HF, which is no longer detrimental. The velocity of the gas streaming through the scrubber has a distinct optimum value for efficiency. A graph shows this efficiency as a function of the gas velocity, and a second graph shows the amount of water necessary for efficient cooling and washing as a function of the temperature of the waste gases. Experiments are planned for a large apparatus with a washed gas volume of 1500 to 2000 m^3/hr.

MINERALOGY, METALLURGY, AND CERAMICS

CORROSION

6038

EROSION-CORROSION RESISTANCE OF METALS. Mars G. Fontana. Ind. Eng. Chem. 44, 101A-4A(1952) Sept.

High velocities, solids in suspension, impingement, turbulence, and other similar conditions often cause greatly increased attack as compared to static or essentially static environments. Several methods and techniques for studying this erosion-corrosion of metals and alloys are reviewed, the apparatus being illustrated.

6039

SOLUTION VELOCITY OF MOLYBDENUM IN NITRIC ACID AT 25°C. T. G. Owe Berg. Z. anorg. u. allgem. Chem. 269, 117-9(1952) Aug. (In German)

The velocity of Mo solution in HNO_3 at 25°C was experimentally determined to be $v = 186c(1-\alpha)$ mg/cm^2/hr, where c is the acid concentration and α is the degree of dissociation. The velocity-determining reaction is the same as for Cu in HNO_3.

6040

CATHODIC PROTECTION OF STEEL IN CONTACT WITH WATER. Leon P. Sudrabin and Henry C. Marks. Ind. Eng. Chem. 44, 1786-91(1952) Aug.

The protective current requirements for the cathodic protection of steel submerged in water are controlled by the same environmental factors that influence the rate of corrosion. Higher dissolved oxygen concentrations, temperatures, or velocities that increase the rate of oxygen diffusion to the cathodic areas tend to increase the protective current requirements. Cathodically deposited calcium carbonate coatings, which impede oxygen diffusion, and resistive coatings decrease the protective current needed. Calcium carbonate is cathodically deposited most readily from water having more than 40 to 50 ppm of both calcium and bicarbonate alkalinity. In the combination of metal protective paints with cathodic protection, the best over-all results are obtained by controlling the potential at the paint surface so that corrosion activity at the coating flaws ceases, and no excess current is used to damage the coatings by ampere-hour effects such as hydrogen evolution, production of alkali, and electroendosmosis. (auth)

6041

INHIBITION OF GALVANIC ATTACK OF STEEL WITH PHOSPHATE GLASSES. G. B. Hatch. Ind. Eng. Chem. 44, 1780-6(1952) Aug.

Glassy phosphate has been found to be a very effective inhibitor for the corrosion of steel coupled to copper and of zinc coupled to either copper or steel. The inhibition of the galvanic attack on steel coupled to copper is chiefly due to a marked increase in the cathodic polarization; the glassy phosphate film on the copper is primarily responsible for the inhibition of the galvanic attack on the steel. The effect of a number of factors, commonly encountered in practice, on the inhibition of the galvanic corrosion of steel coupled to copper with the glassy phosphate is quite similar to their effect on the inhibition of the attack of steel alone. The minor differences that exist appear to be due to the fact that the film of glassy phosphate, chiefly responsible for the inhibition of the galvanic attack, is that on the copper cathode. (auth)

6042

PROTECTIVE FILM FORMATION WITH PHOSPHATE GLASSES. G. B. Hatch. Ind. Eng. Chem. 44, 1775-80(1952) Aug.

The inhibition of the galvanic corrosion of steel coupled to cathodic metals by the glassy phosphates has been found to be chiefly the result of a marked polarization of the cathode. This polarization appears to result from the presence of a glassy phosphate film on the cathode. The film is laid down by an electrodeposition process. A similar process appears operative with uncoupled steel; film deposition apparently takes place on the local cathodic areas as the result of the local action currents. An additional factor enters into the inhibition in differential aeration cells with steel electrodes. The deposition of the glassy phosphate on the cathode causes its open-circuit potential to become less cathodic. Consequently, the potential difference between the two electrodes is lowered in the presence of the inhibitor. Both this decreased potential difference and the increased cathodic polarization are important factors in the reduction of the current flow in these differential aeration cells by the glassy phosphates. (auth)

6043

PROTECTION OF METALS AGAINST PITTING, TUBERCULATION, AND GENERAL CORROSION. H. Lewis Kahler and Philip J. Gaughan. Ind. Eng. Chem. 44, 1770-4(1952) Aug.

This paper covers the history on the use of the chromate inhibitor and points out that chromate, although one of the best treatments for saving steel, gives pitting and tuberculation when used in concentrations insufficient to stop total attack. Phosphate in low concentrations (0 to 10 ppm) at pH 7 to 9, and in higher phosphate concentrations (10 to 100 ppm) in pH range of 5.5 to 7 gave severe pitting tendencies, being worse in this action than chromate alone. Phosphate at high concentrations aided by synergists such as complex cyanides at low pH were found to be practically equivalent to phosphate alone. In research to overcome the shortcomings of phosphate and chromate inhibitors used alone, this combination of two anodic inhibitors, phosphate-chromate, was used over a select pH range and was found to control pitting and tuberculation. In exhibiting this new mechanism for the control of pitting and tuberculation, the phosphate-chromate treatment also showed it could control general corrosion, saving as high as 99% steel at total concentrations as low as 60 ppm. In reducing the number of pits compared to single chromate or single phosphate inhibitors, the combination phosphate-chromate treatment exhibited a new mechanism as though the combination of phosphate and chromate was acting as a new agency and not as two single anodic inhibitors. Field data from plants now using the combination treatment are presented to show that the laboratory research data has been verified in extensive plant practice. (auth)

6044

INHIBITORS FOR ELIMINATING CORROSION IN STEAM AND CONDENSATE LINES. R. C. Ulmer and J. W. Wood. Ind. Eng. Chem. 44, 1761-5(1952) Aug.

Control of corrosion in steam condensate is of vital importance to the power industry. In general, two types of treatments have been advocated to control corrosion: introduction of alkaline substances to neutralize the acidity and introduction of film-forming materials to coat the metal. Corrosion test data were obtained in 600-pound-per-square-inch boiler condensate with representative materials of both types. In general the type that neutralizes acidity was found to give the best results. Raising the pH to around 8.0 decreased the corrosion to an inappreciable amount in the case of iron. Use of film-forming materials also decreased the corrosion rate but not to such a low value as in the case of the neutralizing type. With both types it was found that the rate of corrosion increased at higher concentrations of dissolved oxygen. This also was true in the case of the controls. In the case of copper and brass both types gave good results. In selecting a treatment for a given case, the metals in the system and the dissolved oxygen content of the steam should be considered. (auth)

6045

CORROSION CONTROL WITH ORGANIC INHIBITORS. J. N. Breston. Ind. Eng. Chem. 44, 1755-61(1952) Aug.

Inorganic inhibitors of corrosion by water are generally effective only under alkaline and oxidizing conditions. In the presence of acids, acid brines, high temperatures, reducing conditions, and microbiological action they afford little or no protection. There are many large scale operations in which water is used or handled under such conditions and where effective corrosion control is desirable or necessary. A solution to the problem has been found in organic compounds which, by virtue of their physical and chemical adsorption onto the corroding surface, will protect it from further corrosion. They form protecting films of molecular thickness and are effective in concentrations as low as a few parts per million. The paper outlines the mechanism, properties, and conditions of application of organic inhibitors, and indicates their application in acid cleaning solutions, cooling and refrigerating systems, steam-generating systems, oil wells, and other petroleum production and handling systems. (auth)

6046

EFFECT OF TEMPERATURE ON CORROSION OF METALS BY WATER. Norman Hackerman. Ind. Eng. Chem. 44, 1752-5(1952) Aug.

The influence of systemic temperatures and of temperature gradients on rates and distribution of corrosion reactions is considered, especially for the case of water. A general prognosis of temperature effects cannot be made as a guide for all systems because of the variety of influences that temperature has on the several components of a corrosion system. Explanation of observed effects, and perhaps prediction, is made possible by systematic consideration of the way in which each unit responds to temperature change. A few of the important temperature-dependent properties discussed are oxygen solubility, galvanic potentials, and precipitation rates. (auth)

6047

EFFECTS OF VELOCITY ON CORROSION BY WATER. H. R. Copson. Ind. Eng. Chem. 44, 1745-52(1952) Aug.

Velocity can be a major factor in the corrosion of metals by water, but most available information on the subject is scattered. A general review, therefore, was undertaken with emphasis on Fe, Zn, Cu, and their alloys. Pertinent unpublished data are included. Generally, corrosion increases with velocity, but the effect may be just the opposite. Motion may sometimes eliminate and sometimes cause local attack. It may have a marked effect on galvanic couples. At high velocities mechanical damage accelerates attack by erosion corrosion and cavitation erosion. Experience and a detailed knowledge of operating conditions are essential for the analysis of a particular problem. It is important to be on the lookout for the secondary effects of velocity. 56 references. (auth)

6048

CORROSION RESISTANCE OF TITANIUM, ZIRCONIUM, AND STAINLESS STEEL. INORGANIC CHLORIDES. Lex B. Golden, I. Roy Lane, Jr., and Walter L. Acherman. Ind. Eng. Chem. 44, 1935-9(1952) Aug.

Corrosion rates for Ti, Zr, and 20-29 Cr-Ni type stainless steel were determined in various concentrations of ferric, cupric, mercuric, stannic, Ni, manganous, Na, ammonium, Ca, Mg, Ba, Zn, and Al chloride solutions. With the exception of concentrated Al chloride solutions Ti is fully resistant to attack by all concentrations of these metal chlorides. Tests with some lots of powder-metallurgy Ti in alkali and alkaline earth chlorides resulted in a peculiar blister type of pitting. This is ascribed to the presence of impurities in the metal, particularly Mg chloride inclusions. Selected lots of powder-metallurgy Ti known to be essentially free of these inclusions failed to exhibit this phenomenon. Arc-melted Ti with a very low Mg chloride content also showed no pitting. The only solution in which Ti showed excessive corrosion was 25% Al chloride at 100°C. S.S. shows poor corrosion resistance to heavy metal chlorides, except in very dilute solutions at low temperatures. This alloy is susceptible to the pitting type of attack where, although indicated corrosion rates may be quite low, the alloy must be rated unsatisfactory because of rapid penetration and perforation of the sample. Concentrated solutions of Na, ammonium, Ca, and Mg chloride at elevated temperatures also cause varying degrees of pitting in S.S. Zr, unlike Ti, is not resistant to solutions of ferric and cupric chloride unless both the concentration and the temperature are low. It suffers an embrittlement type of attack which, in the most severe form, causes complete disintegration of the metal to a fine powder. However, in all other chloride solutions Zr is almost completely resistant to attack. Ti and Hastelloy C were nearly completely resistant to attack by hypochlorite solutions, but two different types of S.S. were badly pitted. Zr was highly resistant, although there was evidence of shallow embrittlement in the higher concentrations of hypochlorite, especially at elevated temperatures. (auth)

6049

CORROSION RESISTANCE OF TITANIUM, ZIRCONIUM, AND STAINLESS STEEL; MINERAL ACIDS. Lex B. Golden, I. Roy Lane, Jr., and Walter L. Acherman. Ind. Eng. Chem. 44, 1930-5(1952) Aug.

Corrosion rates for Ti, Zr, and 20-29 Cr-Ni type stainless steel were determined in various concentrations of sulfuric, hydrochloric, nitric, phosphoric, and mixed acids. Results in sulfuric and hydrochloric acids showed that, in general, all three materials show greater resistance to corrosion in air-free solutions than in air-saturated solutions. In sulfuric acid solutions the S.S. is superior to Ti under all conditions, whereas Zr excels S.S. in all sulfuric acid solutions below 80% concentration. The three metals show excellent resistance to all concentrations of nitric acid. In mixed acid solutions both Ti and S.S. have better corrosion resistance than Zr. At lower temperatures the addition of small amounts of nitric acid to sulfuric inhibits corrosion of both Ti and S.S. but increases that of Zr. Of the three metals only Zr is fully resistant to corrosion in hydrochloric acid solutions. Ti is satisfactorily resistant to all concentrations of phosphoric acid only at lower temperatures. The S.S. shows better resistance than Zr, especially in boiling solutions. Ti is fully resistant to an atmosphere of water-saturated chlorine, while Zr, type 316 S.S., and 20-29 Cr-Ni S.S. are badly attacked. (auth)

6050
PITTING CORROSION CHARACTERISTICS OF ALUMINUM; INFLUENCE OF Mg AND Mn. P. M. Aziz and Hugh P. Godard. Ind. Eng. Chem. 44, 1791-5(1952) Aug.

This work was undertaken to determine the influence of alloying Mg and Mn with Al upon its pitting probability and pitting rate. Al in the purity range 99.5 to 99.99% was investigated using additions of 1.0% Mg, 1.25% Mn, and 0.5% Mg–0.5% Mn. The additions reduce the probability of pitting and also the rate. The Mg-Mn addition reduces the pitting probability most but the straight Mn addition has the greatest effect in slowing the rate of pitting. Above 99.7% purity the probability of pitting is reduced with increasing purity. The beneficial effects of Mg and Mn are valid in the range above 99.5% Al. Al, to be used in environments where pitting corrosion may be encountered, should be alloyed with Mg and/or Mn. Commercial alloys of this type are 52S (2.5% Mg) and 3S (1.25% Mn). (auth)

6051
KNIFE-LINE ATTACK OF STAINLESS STEELS. Mars G. Fontana. Ind. Eng. Chem. 44, 87A-90A(1952) Aug.

Knife-line attack is the intergranular corrosion of stabilized stainless steels in a narrow band of the plate or sheet material immediately adjacent to the weld. Corrosion tests on various stainless steels in which knife-line attack developed are illustrated, and differences in susceptibility are discussed.

GEOLOGY AND MINERALOGY

6052
Centre de Physique Nucléaire de L'Université Libre de Bruxelles
APPLICATION DE LA METHODE DU RaD A LA MESURE DE L'AGE "CHIMIQUE" D'UN MINERAL D'URANIUM. [APPLICATION OF THE RaD METHOD TO THE MEASUREMENT OF THE CHEMICAL AGE OF A URANIUM MINERAL], by F. Begemann, H. von Buttlar and F. G. Houtermans. Aug. 1952. 36p. (NP-4104; Bulletin Note No. 37)

The RaD method for determining the chemical age of a U mineral consists of measuring the ratio Pb/U by use of the ratio Pb^{210}/Pb. The determination can be made on a very small amount of material. The conditions of validity of the method as well as the methods of measuring Pb^{210} are considered. Experimental verification of the method was effected on two formations of pitchblende. One part was determined analytically and the other part was determined by the Pb^{210} method. Pb^{210} is measured by counting the β particles from Bi^{210}.

6053
Geological Survey
METHODS OF ANALYSIS USED IN THE TREATMENT OF COLORADO PLATEAU CARNOTITE FOR AGE STUDIES, by Robert G. Milkey. Aug. 1952. 19p. (TEI-245)

In connection with mineralogic studies of Colorado Plateau carnotite ores, for purposes of determining age of materials, standard chemical procedures were used, although some modifications were found necessary in the application of these methods to carnotite ores. For example, it was found that the dithizone used to extract the Pb from carnotite was oxidized completely by some constituent of the ore, and this difficulty had to be overcome before the method could be made applicable to the analysis. In addition to the modified procedure for quantitative spectrophotometric determination of Pb, also included is the procedure devised for the preparation of Pb iodide from carnotite ores for purposes of Pb-isotope analysis, as well as volumetric and fluorimetric methods for determining the U content of carnotite.

6054
Geological Survey
TERMINOLOGY FOR STRATIFICATION AND CROSS-STRATIFICATION IN SEDIMENTARY ROCKS, by Edwin D. McKee and Gordon W. Weir. Arizona Univ. and Geological Survey. Sept. 1952. 17p. (TEI-269)

A terminology is suggested for stratified and cross-stratified rock units that will aid the field geologist in describing these structures. Qualitative terms, describing the character of rock layering, are stratification, stratum, cross-stratification, cross-stratum, set, co-set, and composite-set. Quantitative terms, applying to the thickness of stratification, are very thick-bedded, thick-bedded, thin-bedded, very thin-bedded, laminated, and thinly laminated. Quantitative terms, applying to the thickness of units into which the rock splits, are massive, blocky, slabby, flaggy, shaly, platy, and papery. A classification of cross-stratification based primarily on the character of the lower bounding surface of a set of cross-strata is suggested. Features of secondary importance in this classification are the shape of each set of cross-strata, the attitude of the axis, the symmetry of the cross-strata with respect to the axis, the arching of the cross-strata, the dip of the cross-strata, and the length of individual cross-strata. (auth)

6055
Geological Survey
AIRBORNE RADIOACTIVITY SURVEYS IN THE MOJAVE DESERT REGION, KERN, RIVERSIDE, AND SAN BERNARDINO COUNTIES, CALIFORNIA, by R. M. Moxham. July 1952. 30p., 4 illus. (TEM-360)

Airborne radioactivity surveys in the Mojave Desert region, Kern, Riverside, and San Bernardino counties, Calif., were made in five areas recommended as favorable for the occurrence of radioactive raw materials: (1) Rock Corral area, San Bernardino county; (2) Searles Station area, Kern county; (3) Soledad area, Kern county; (4) White Tank area, Riverside and San Bernardino counties; and (5) Harvard Hills area, San Bernardino county. Anomalous γ radiation was detected in all but the Harvard Hills area. The radioactivity anomalies detected in the Rock Corrals area are of the greatest amplitude yet recorded by the airborne equipment over natural sources. The activity can apparently be attributed to Th-bearing minerals associated with roof pendants of crystalline metamorphic rocks in a granitic intrusive. In the Searles Station, Soledad, and White Tank areas, several radioactivity anomalies of medium amplitude were recorded; these anomalies suggest possible local concentrations of radioactive minerals. (auth)

6056
Geological Survey
RECONNAISSANCE FOR URANIFEROUS ROCKS IN NORTHEASTERN WIND RIVER BASIN, WYOMING, by H. A. Tourtelot. Aug. 1952. 14p. (TEM-445)

A reconnaissance for uraniferous rocks in the northeastern part of the Wind River Basin was made in July and August 1951 in the course of other work. Some radioactivity anomalies, chiefly in granite, that had been detected by airborne equipment in November 1950 were checked on the ground in addition to tuffs of Tertiary age and associated lignite, coal, and carbonaceous rocks. A tuff of middle or late Eocene age that contains 0.003% U was as high in U as any rock found in this area. One sample of granite also contained 0.003% U. The equivalent U content of the granite was 2 to 5 times as large as the U content, presumably because of the presence of Th. Further investigations in the northeastern part of the basin do not seem to be warranted at the present time, but more reconnaissance testing for uraniferous rocks will be done whenever work on other material is undertaken there. (auth)

METALS AND METALLURGY

6057
Atomic Energy Research Establishment, Harwell, Berks (England)
A DISCUSSION OF THE FACTORS AFFECTING THE CONSTITUTION OF ZIRCONIUM ALLOYS, by P. C. L. Pfeil. June 27, 1952. 40p. (AERE M/R-960)

Because of the probable future technological importance of zirconium alloys, an attempt is made to extend existing alloy theory to zirconium. A forecast is made of the elements which may dissolve in the metal and attention is given to the probable influence on the allotropic transition. Discussion of the observed alloying behavior of zirconium and of the behavior of similar titanium alloys indicates that there is more than one factor operative in determining the effects of solute elements on the relative stabilities of the allotropes. A program of experimental work to find out more about the factors governing the alloying behavior of zirconium is suggested. The alloy systems with silver, aluminum, niobium, and molybdenum appear to be of particular theoretical importance, while further information is required about zirconium-titanium alloys. (auth)

6058
Institute of Engineering Research, Univ. of Calif., Berkeley
EFFECT OF SOME SOLID SOLUTION ALLOYING ELEMENTS ON THE CREEP PARAMETERS OF NICKEL; TENTH TECHNICAL REPORT, by T. H. Hazlett, V. F. Zackay, and E. R. Parker. Aug. 1952. 27p. (COO-64)

The equation $\epsilon - \epsilon_0 = At^b$ has been proposed as a general relationship between strain and time. ϵ = total true strain, ϵ_0 = instantaneous strain at moment of loading, t = time, and A and b are constants. It has been found that A, b, and ϵ_0 vary with applied stress, temperature, structure, and alloy content. The influence of alloying on these creep parameters was studied. The equation $\epsilon - \epsilon_0 = At^b$ describes the constant-stress creep curves for Ni–Co, Ni–Fe, Ni–W, and Ni–Ti solid solution alloys. As the alloy content increases, A decreases exponentially, b increases directly, and ϵ_0 decreases directly. The data indicate the possibility of correlations between creep parameters and other material constants.

6059
Ames Lab.
THE STRUCTURE AND RESISTIVITY OF GADOLINIUM IN THE NEIGHBORHOOD OF ITS CURIE POINT, by J. R. Banister, F. Barson, S. Legvold and F. H. Spedding. Aug. 20, 1952. 5p. (ISC-265)

X-ray structure studies of Gd at room temperature revealed a hexagonal close-packed structure. Variation of the lattice parameters of Gd with temperature was determined. The electric resistivity of a sample of Gd containing 0.02% Mg, 0.03% Ca, 0.01% Tb, 0.02% Fe, and 0.15% Sm was also determined.

6060
Illinois Univ.
A THEORY OF FATIGUE BASED ON A STATISTICAL DISTRIBUTION OF GRAIN SIZE, by M. E. Lunchick. July 1952. 88p. (NP-4024; Technical Report No. 32)

A theory of fatigue behavior is developed based on the failure of the grains as the basic structural components of a metal. Briefly, the failure is described to initiate at the larger or weaker grains in which disruption by slip occurs. With further repeated loading, microscopic cracks nucleating at the disrupted grains and propagating throughout the member are presented as the mechanism of fatigue failure. Slip and subsequent microscopic crack initiation is based on Bragg's hypothesis which expresses the elastic strength of a grain as an inverse function of the mean free path for slip. Confining the analysis to a single-phase metal, the mean free path for slip is taken equal to the grain size, for the grain boundaries inhibit slip. Using a log-normal distribution of grain size and the mean free path for slip equal to the grain size, a mathematical correlation between the strength of the metal and its structure is established. Assuming as a first approximation that the fatigue life varies inversely with the number of microscopic cracks initiated, the role of microscopic crack initiation in influencing the fatigue life is determined. The influence of rate of propagation of the microscopic cracks on the fatigue life is expressed empirically from past experimental data by assuming a linear relationship between the relative stress level and the logarithm of the number of cycles from microscopic crack initiation to final failure. The interaction of crack initiation and rate of crack propagation is then given mathematical expression as an equation for the fatigue life. According to the theory developed, the fatigue strength and fatigue life of a single-phase metal is increased by: (a) decreasing the mean grain size, (b) making the material more uniform in grain size distribution, and (c) decreasing the volume of material subjected to stresses above a given reference stress. Finally, scatter of fatigue life and size effect in fatigue specimens are explained qualitatively on the basis of the heterogeneity of the material that results in a wide variation in microscopic cracks initiating on the planes of failure. (auth)

6061
New York Univ.
TITANIUM-RICH TERNARY PHASE DIAGRAMS OF TITANIUM WITH MANGANESE AND CARBON, AND CHROMIUM AND CARBON; INTERIM TECHNICAL REPORT NO. 1, by E. Ence, W. Kirk, and H. Margolin. Mar. 17, 1952. 28p. (NP-4028; Interim Technical Report No. 1; WAL 401/105-9(pt.3))

Five isothermal sections of the Ti–Mn–C system were constructed at 850, 900, 950, 1050, and 1150°C based on data obtained from a group of 32 alloys containing 0.1 to 1% C and 0.2 to 10% Mn. Three vertical sections of 0.1, 0.3, and 1% constant-C compositions were prepared. Five isothermal sections of the Ti–Cr–C system were constructed at 800, 900, 1000, 1100, and 1200°C from data on 32 alloys containing 0.2 to 10% Cr and 0.1 to 2% C. Four vertical sections for 0.1 and 0.3% C and 0.5 and 1% Cr constant compositions were prepared. Additional methods were developed for the identification of phases.

6062
New York Univ.
TITANIUM-RICH TERNARY PHASE DIAGRAMS OF TITANIUM WITH MANGANESE AND NITROGEN, AND CHROMIUM AND NITROGEN, by E. Ence, W. Kirk, and H. Margolin. Mar. 24, 1952. 16p. (NP-4029; WAL-401/105-9(pt.II); Interim Technical Report No. 1)

Six isothermal sections of the Ti–Mn–N system were constructed at temperatures between 850 and 1200°C based on data from two constant composition sections at 0.5 and 1.0% N. A group of 32 alloys containing 0.2 to 10% Mn and 0.2 to 2% N were used in the preliminary study of this ternary diagram. Isothermal sections of the Ti–Cr–N system at 900, 1000, 1100, and 1200°C and constant-composition sections at 1 and 4% Cr and 0.5 and 1% N compositions were constructed based on data obtained from 24 alloys containing 0.2 to 10% Cr and 0.2 to 1% N.

6063
Institute of Engineering Research, Univ. of Calif., Berkeley
FUNDAMENTAL STUDIES RELATED TO THE ORIGIN AND NATURE OF CREEP OF METALS; FOURTH TECHNICAL REPORT [ON] VARIATION OF PLASTIC PROPERTIES WITH ANNEALING PROCEDURE IN ZINC SINGLE CRYSTALS, by Choh Hsien Li, Jack Washburn, and Earl R. Parker. July 1952. 16p. (NP-4053; Technical Report No. 4; U-23666)

Single crystals of Zn, most of which were grown in an He atmosphere, were acid-machined from spherical single crystals 1 in. in diameter so that the slip plane (0001) was at right angles to the axis of the cylinder. A shear stress was applied along the slip direction $[2\bar{1}\bar{1}0]$; each crystal was deformed to 10% strain, cooled at a rate of 3 or 30°C/min, and then annealed for 1 hr at 200 to 400°C. Room-temperature flow stress, for given annealing time and rate of cooling, increased with rising annealing temperature. The crystalline state at room temperature appeared to be characteristic of the annealing procedure. Differences in stress-strain curves were observed for changes in the apparent yield stress and in the amount of plastic flow prior to the break in the curve. Crystals prepared with a small amount of Cu in solid solution or grown in an N atmosphere gave stress-strain curves for all annealing treatments similar to crystals grown in He. The presence of N did not increase the effect of annealing temperature. Introduction of substructures into the crystals raised their yield stress under all heat-treatment conditions and exaggerated the effect produced by the high-temperature anneal. The data indicate that the distribution or nature of imperfections in annealed crystals changes with annealing procedure. When cooling occurs at moderately slow rates, the annealing temperature has a profound effect upon the mechanical behavior of the crystal. (NRS abst.)

6064

Institute of Engineering Research, Univ. of Calif., Berkeley
FUNDAMENTAL STUDIES RELATED TO THE ORIGIN AND NATURE OF CREEP OF METALS; FIFTH TECHNICAL REPORT [ON] RECOVERY IN SINGLE CRYSTALS OF ZINC, by R. Drouard, Jack Washburn, and Earl R. Parker. July 1952. 15p. (NP-4061; Technical Report No. 5; U-23665)

Stress-strain curves were studied for prestrained Zn single crystals held for various periods of time at temperatures above that employed for straining. The shear-type specimens were prepared by the method previously described (TIP U23666). The crystal was strained at –50°C until it reached a maximum shear stress (strain rate ~5%/min), unloaded, and then heated to the recovery temperature. Curves were obtained after the temperature was reduced again to –50°C; the unloaded specimen was annealed for 1 hr at 375°C in an He atmosphere, and then cooled to room temperature. Most tests were made with specimens prestrained about 8%; other specimens with 4 and 25% prestrain showed similar characteristics to those with 8% prestrain. The percentage of recovery appeared to be independent of stress level and amount of strain hardening whenever the strain was confined to simple shear; apparently strain hardening for a simple slip deformation occurs by a single mechanism. Data indicated that migration of vacant lattice sites could be the rate-controlling factor during recovery. (NRS abst.)

6065

Institute of Engineering Research, Univ. of Calif., Berkeley
FUNDAMENTAL STUDIES RELATED TO THE ORIGIN AND NATURE OF CREEP OF METALS; SIXTH TECHNICAL REPORT [ON] EFFECT OF STRESS ON INITIAL CREEP RATE OF ZINC SINGLE CRYSTALS, by N. Brown, Jack Washburn and Earl R. Parker. July 1952. 14p. (NP-4062; Technical Report No. 6; U-23664)

Single crystals of Zn were annealed at 260°C for 1 hr, air-cooled, and step-loaded to 25 psi. Creep was then allowed to occur for 1 hr, and the unloading was done in steps. The crystal was oriented so that shear stress was applied parallel to the slip direction $[2\bar{1}\bar{1}0]$. Tests were conducted with the initial load supported by a pin, the specimen being stress-free. The specimen was deformed at a rate of about 0.0025 in./min. As the specimen became work-hardened, it supported more of the load until the portion supported by the pin became zero. The creep began under a constant stress. Large variations in creep rate were obtained for a given stress. A slight scatter in the yield occurred regardless of the annealing procedure. The increment of stress above some minimum stress rather than the actual stress appeared to govern the creep of Zn single crystals. Initial-creep rate was proportional to the initial strain, γ_0, and thus was proportional to the actual stress minus a yield stress, $(\sigma - \sigma_0)$. (NRS abst.)

6066

Arcos Corp.
THE WELDING OF TYPE 347 STEELS. TECHNICAL REPORT NO. 1 ON THE EFFECT OF COMPOSITION AND MICROSTRUCTURE ON THE MECHANICAL PROPERTIES AND CRACK SENSITIVITY OF TYPE 347 WELD METALS, by Lorin K. Poole. Aug. 28, 1952. 23p. (NYO-3495; Technical Report No. 1)

The effect of variations of composition on the mechanical properties and crack sensitivity of fully austenitic Type 347 weld deposits were studied. Laboratory tests indicate that sound, fully austenitic welds not susceptible to cracking cannot be made by controlling only the Si content or the Nb content in the range 0 to 1.06% Nb; sound, fully austenitic welds free of cracking difficulties can, however, be produced by increasing carbon to 0.12% or by increasing the Mn content to 5%. Electrodes of the most promising compositions have been prepared for field tests. (auth)

6067

Tennessee Univ.
QUARTERLY REPORT FOR PERIOD MAY 1–JULY 31, 1952 ON EFFECT OF WETTING ON HEAT TRANSFER CHARACTERISTICS OF LIQUID METALS, by R. M. Boarts, H. Chelemer and W. K. Stromquist. July 31, 1952. 5p. (ORO-76)

Contact angle measurements are reported for several Hg-steel systems and dilute Na and Mg amalgams. Tests on the heat transfer system are analyzed, and preliminary results on the physical properties of Hg and dilute amalgams are reported.

6068

MANY MECHANISMS AT WORK PRODUCING GRAIN REFINEMENT IN LIGHT METALS. Harold Bernstein. J. Metals (N. Y.) 4, 926-30(1952) Sept.

Theories concerning the mechanism of grain refinement in binary alloys are reviewed critically, particular attention being paid to the alloys of Al. The roles played by growth restriction, adsorption of solute atoms, surface tension, nucleation, and vibration are considered. 15 references.

6069

OBSERVATIONS ON THE LATTICE PARAMETERS OF THE ALPHA AND TiO PHASES IN THE TITANIUM-OXYGEN SYSTEM. W. Rostoker. J. Metals (N. Y.) 4, 981-2(1952) Sept.

Data on the variation of the lattice parameters of the α c.p.h. and TiO phases in the Ti-O systems are presented. The valence states of the O ion and the lattice structures in these phases are discussed.

6070

SOME OBSERVATIONS OF SUBGRAIN FORMATION DURING CREEP IN HIGH PURITY ALUMINUM. Italo S. Servi, John T. Norton, and Nicholas J. Grant. J. Metals (N.Y.) 4, 965-71 (1952) Sept.

Coarse-grained high-purity Al was tested in creep at temperatures of 400 to 1200°F to develop subgrain structures. Measurements of subgrain size, distribution, and rotation were made from x-ray-diffraction patterns. Subgrain size and distribution were checked metallographically, and the size was compared with average slip band spacing. The slip family was determined for several specimens. (auth)

6071
EFFECT OF THE CHEMICAL COMPOSITION OF CERTAIN BINARY ALUMINUM-BASE ALLOYS ON THEIR TENDENCY TO CRACK FORMATION IN THE GAS-WELDING PROCESS. S. V. Avakyan and N. F. Lashko. Avtogennoe Delo, No. 10, 1-6(1951) Oct. (In Russian)

Crystallization cracks and conditions for their formation in alloys of Al with Sn, Cu, Mg, Zn, Ag, Si, Mn, Fe, Bi, Cd, and Ce were investigated. Elimination of cracks may be achieved under the following conditions: insignificant difference in crystallization temperatures of Al and eutectic; small amount of second phase in eutectic distributed along grain boundaries of solid solution in form of separate inclusions; and sufficient quantity of eutectic to "heal" fissures formed in alloy during crystallization.

6072
THE SEPARATION OF STACKING FAULT BROADENING IN COLD-WORKED METALS. B. E. Warren and B. L. Averbach. J. Applied Phys. 23, 1059(1952) Sept.

In the cold-working of face-centered-cubic metals, slip on the (111) planes may leave mistakes in a regular ABCABC sequence. These mistakes, called stacking faults, may be responsible for part of the broadening of an x-ray reflection. It is shown that stacking faults produce no broadening in the (333) and (600) reflections from single crystals or samples of preferred orientation. How to separate particle-size, distortion, and stacking-fault broadenings by plotting several orders of (111) and (200) reflections is demonstrated.

6073
LATTICE-SPACING RELATIONSHIPS IN ALUMINIUM-RICH SOLID SOLUTIONS OF THE ALUMINIUM-MAGNESIUM AND ALUMINIUM-MAGNESIUM-COPPER SYSTEMS. D. M. Poole and H. J. Axon. J. Inst. Metals 80, 599-604 (1952) July.

The lattice-spacing/composition relationship for the Al-rich Al-Mg solid solution has been reinvestigated, using two samples of Mg of different purities. Increasing the purity of the Mg reduces the curvature of the relationship at low concentrations of Mg and causes the linear portion of the curve to become more steep. The Al-rich ternary Al–Mg–Cu solid solution has also been investigated, using Mg of high purity; in this solid solution there is a slight negative deviation from the additive effect which might be expected from Cu and Mg separately. Accurate control of alloy composition is of great importance and is likely to hold up research in this field. (auth)

6074
THE EFFECT OF ZIRCONIUM ON THE PROPERTIES AND STRUCTURE OF SUPERDURALUMIN, WITH PARTICULAR REFERENCE TO FORGINGS. M. Tournaire and M. Renouard. J. Inst. Metals 80, 593-7(1952) July.

Superduralumin A-U4 GI (duralumin FR) is frequently used in France for high-strength forgings. However, these forgings, particularly those of large size, are susceptible to quenching cracks and in addition, like forgings in ordinary duralumin, they show considerable variations in grain size in different parts of the same section. In the course of researches aimed at rendering forged superduralumin less liable to quenching cracks, it has been found that if the Mn content of the alloy is replaced, wholely or partly, by 0.25% Zr (it is impossible to add more than 0.25%), forgings are obtained whose mechanical properties are in no way inferior but which have a remarkably fine and uniform grain size. This advantage, valuable in itself, is not the only one resulting from the addition of Zr, for the new alloy can be cast, by the semicontinuous method, into very large billets with less risk of fissures than with ordinary superduralumin, and it can be forged with greater ease. (auth)

6075
FACTORS AFFECTING EQUILIBRIUM IN CERTAIN ALUMINIUM ALLOYS. E. C. Ellwood. J. Inst. Metals 80, 605-8(1952) July.

The lattice spacings and densities of solid solutions of Cu, Mg, and Ag in Al have been measured at 25°C. No anomalies were found in the Al-Cu solution. In the Al-Mg solution the slight curvature in the lattice-spacing/composition curve reported by Axon and Hume-Rothery (Proc. Roy. Soc. (London) A193, 1(1948)) is confirmed, and vacant sites are formed in the solid solution. An expansion in the lattice occurs between 10 and 14 at. % Ag in the Al-Ag system, but no vacant sites are found. It is deduced that the anomalies are the result of Brillouin-zone overlaps and that the two latter solid solutions resemble that of Zn in Al in some respects. The solid solutions are not identical in their behavior, and it is concluded that the effects produced are characteristic of the alloying element. It is shown that where Brillouin-zone effects are found the solid solutions are not ideal. (auth)

6076
CORRELATION OF CREEP PROPERTIES BY A DIFFUSION ANALOGY. Leon Green, Jr. J. Applied Mechanics 19, 320-6(1952) Sept.

The necessity of atom movements for both creep and self-diffusion suggests a method of correlating the constant-stress creep properties of pure metals. The concept of steady-state creep is discarded, and two empirical approximations for the strain-time behavior of pure polycrystalline metals lead to a creep equation defining an activation energy as the only undetermined constant. For cases where the orientation of individual crystals is important, a second constant is required. Application of this equation to published creep data effects a correlation which indicates that the apparent activation energies observed for creep and self-diffusion show a similar temperature dependence. The effect of stress upon the activation energy for several metals is described approximately, but the need for further experiments encompassing lower values of stress is revealed. The qualitative effects of impurities, grain size, cold-working, and surface conditions upon creep as predicted by a diffusion analogy are found to be in agreement with experimental results, but it is noted that the analogy does not hold if creep deformation is obtained as a result of slip. (auth)

6077
NOTE ON THE EFFECT OF OXYGEN AND NITROGEN ON THE HARDNESS AND LATTICE PARAMETER OF HIGH PURITY VANADIUM. S. Beatty. J. Metals (N. Y.) 4, 987-8(1952) Sept.

Small additions of O and N result in a sharp increase in the lattice parameter and hardness of V. Progressive x-ray-diffraction line broadening is observed with increasing impurities content. This broadening appears to be caused by nonuniform composition.

PHYSICS

6078
Brookhaven National Lab.
THE MAGNETIC SUSCEPTIBILITIES OF NiF_2 AND CoF_2 AT INTERMEDIATE TEMPERATURES, by Norman Elliott. [nd] 8p. (BNL-1225)

The magnetic susceptibilities of NiF_2 and CoF_2 have been measured at temperatures between that of liquid air and room temperature and results are tabulated. Methods for the preparation of NiF_2 and CoF_2 are given. The compounds were analyzed for the metal ions and were found to agree

with the stoichiometric formulas to ±0.10%.

6079
Brookhaven National Lab.
THE PROBABILITY OF INTERNAL CONVERSION OF K-SERIES RADIATION OF Au ARISING FROM THE INTERACTION OF THE L SUB-SHELLS, by J. W. Mihelich. [nd] 4p. (BNL-1241)

Experimental values for the relative probability of the Auger transitions L_I, $L_I \rightarrow K$, ∞; L_I, $L_{II} \rightarrow K$, ∞; L_I, $L_{III} \rightarrow K$, ∞; L_{II}, $L_{II} \rightarrow K$, ∞; L_{II}, $L_{III} \rightarrow K$, ∞; and L_{III}, $L_{III} \rightarrow K$, ∞ were obtained.

ASTROPHYSICS

6080
DISCRETE MODEL OF STAR (OSCILLATIONS AND EXPLOSION). I. S. A. Zhevakin. Astron. Zhur. 29, 37-48 (1952) Jan.-Feb. (In Russian)

It is shown that properties of a discrete model are similar to those of models available in the astrophysical literature. Auto-oscillations of a model with one degree of freedom, sustained by action of a swinging mechanism connected to thermonuclear energy release, are studied. It is shown that nuclear reactions are not the cause of stellar oscillations.

COSMIC RADIATION

6081
ON THE THEORY OF CASCADE SHOWERS. I. Jun Nishimura and Koichi Kamata. Progress Theoret. Phys. (Japan) 7, 185-92(1952) Feb.

An improved mathematical treatment for the calculation of cascade theory is presented. The solution corresponding to a single incident electron derived by this method is identical with that of Snyder (Phys. Rev. 76, 1563(1948)) and Scott (Phys. Rev. 80, 611(1950)). The method is mainly due to the principle of analytic continuation but somewhat different from that of Bhabha and Chakrabarty (Phys. Rev. 74, 1352(1948)). It is also applicable to other inhomogeneous integro-differential equations and in particular should be useful for further works on cascade theory. For an example, it is shown that the lateral and angular distribution functions are derivable analytically by this method. (auth)

6082
THE THIRD AND FOURTH MAXIMA OF THE SHOWER CURVE. H. Thurn. Z. Naturforsch. a7, 497-9(1952) July. (In German)

Rossi curves determined at 100 and 600 m altitude are illustrated. Positions of the third and fourth maxima and their dependence on local atmospheric pressure are delineated.

6083
THE MEAN ENERGY OF THREE-TRACK NUCLEAR DISINTEGRATIONS PRODUCED BY COSMIC-RAY PARTICLES. D. A. Tidman and P. E. Hodgson. Phil. Mag. (7) 43, 992-3 (1952) Sept.

Brown et al. (Phil. Mag. 40, 862(1949)) measured the total energy of the particles emitted from disintegrations caused by cosmic rays as a function of star size for stars of 4 to 18 tracks. Since these investigators missed a considerable number of small stars, which would affect the empirical energy relation, it seemed worth while to repeat the measurements of mean energy of 3-track stars in G5 emulsion exposed under no absorber. Certain assumptions were made in including data of other observers. The mean energy of the 3-track stars was found to be 196 ± 18 Mev.

6084
INTENSITY DISTRIBUTION OF INDIVIDUAL TRACKS PRODUCED BY COSMIC RADIATION IN NUCLEAR EMULSIONS ROTATING ON A POLE STAR AXIS AND RETAINING A FIXED ORIENTATION WITH RESPECT TO THE SUN. Max Morand and Simone Desprez-Rebaud. Compt. rend. 235, 294-6(1952) July 28. (In French)

A clockwork mechanism, erected at Puy de Dôme observatory, caused nuclear plates to rotate exactly once every 24 hr about a polar axis. Analysis of the spatial distribution of 4083 separate tracks, attributed mostly to protons of energy <120 Mev, showed an intensity minimum in the direction of the sun.

6085
LOCAL PENETRATING SHOWERS FROM WATER AND CARBON. C. B. A. McCusker and D. D. Millar. Proc. Phys. Soc. (London) A65, 758(1952) Sept. 1.

A cloud chamber of diameter 30 cm and illuminated depth 15 cm with a 2.5-cm Pb plate across the middle was operated for 4.5 months under a layer of water 90 cm thick. Numbers of events having various multiplicities of penetrating particles are tabulated. The average multiplicity of penetrating particles from carbon was 2.25 ± 0.13 and that for showers from water was 2.16 ± 0.13. If geometric cross section for interaction for C, O, and H is assumed and the multiplicity from the O of the water is equal to that from the C, this gives an average multiplicity for showers from H of 1.88 ± 0.68.

6086
INCREASE OF COSMIC-RAY INTENSITY AT SEA LEVEL DURING SAND STORMS. M. Abd El-Wahab, L. Allegretti, M. G. El-Fandi, and M. El-Sherbini. Nuovo cimento (9) 9, 734-5(1952) Aug. (In Italian)

At Alexandria, Egypt, desert winds (khamsin) of 50 to 60 km/hr velocity produce clouds of minute particles 0.2 to 100 μ in diameter to a height of 500 to 1000 m. During these storms the total cosmic-ray intensity increases as much as 50%. Good hourly correlation is observed between intensity and wind velocity.

6087
THE ALTITUDE VARIATION OF PENETRATING SHOWERS. A. L. Hodson. Proc. Phys. Soc. (London) A65, 702-8(1952) Sept. 1.

The altitude variations of local penetrating showers and of extensive penetrating showers have been studied between sea level and 33,500 ft. The attenuation length in air of the radiation producing local penetrating showers is found to be 129 ± 2 g/cm^2. This value has been corrected for the effect of deviations of the radiation from vertical incidence on the apparatus. Local penetrating showers observed under a transition layer of Pb 10 cm thick are about 750 times more frequent at 33,500 ft and 500 times more frequent at 30,000 ft than at sea level. (auth)

6088
ON THE THEORY OF THE ANGULAR AND LATERAL SPREAD OF THE NUCLEON COMPONENT OF THE COSMIC RADIATION. H. S. Green and H. Messel. Proc. Phys. Soc. (London) A65, 689-701(1952) Sept. 1.

The three-dimensional development of the nucleon component of extensive air showers is investigated. A vectorial diffusion equation is derived for the phase-space distribution of the nucleons and solved as far as required to determine the mean-square angular deviation, and the mean-square distance from the shower axis. Account is taken of the variation of density in the atmosphere, and numerical results are obtained for all altitudes. These are exhibited graphically. The lateral spread of the nucleon cascade in Pb is also determined and the results tabulated. A full discussion is given of the significance of the numerical values obtained. (auth)

6089
BURSTS IN MATERIAL OF LOW ATOMIC NUMBER. F. E. Driggers. Phys. Rev. 87, 1080-90(1952) Sept. 15.

A large ionization chamber has been used to obtain an

integral burst-size frequency distribution by amplifying and recording the electron pulses produced by bursts. A comparison of the integrated burst rate from the upper hemisphere with that produced by primaries with a small zenith angle permitted an estimate of the burst rate resulting from interactions of the N component. Calculations were made of the expected burst distributions arising from the electromagnetic interactions (bremsstrahlung, knock-on, and direct pair production) of spin-0 and spin-½ μ mesons. About ⅓ of the bursts observed under 400 g/cm^2 of sand-lime brick and concrete at sea level were attributed to interactions of the N component. The remaining burst rate agreed with the rate calculated for spin ½ to within the estimated uncertainty of the comparison—about 20%. Lack of quantitative information concerning the nuclear interactions of μ mesons prevents an estimation of the actual electromagnetic cross sections. The expected Z dependence of μ-meson bursts was roughly confirmed by a comparison with results obtained elsewhere under material of higher Z. (auth)

6090
MEAN FREE PATH OF THE HIGH ENERGY N COMPONENT OF COSMIC RADIATION. Robert R. Brown. Phys. Rev. 87, 999-1002(1952) Sept. 15.

The mean free path of charged particles that produce penetrating showers has been measured in C, S, and Fe. Preliminary measurements with C were carried out at 130-m elevation and the mean free path obtained was 89 ± 12 g/cm^2. Measurements at 2765-m elevation gave mean free paths in C, S, and Fe of 65 ± 5, 76 ± 7, and 115 ± 12 g/cm^2, respectively. The C data were used to get an estimate of the mean free path in nuclear matter of high-energy nucleons. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

8091
Brookhaven National Lab.
SOME ASPECTS OF NEUTRON SINGLE CRYSTAL ANALYSIS, by Ray Pepinsky. [nd] 9p. (BNL-1247)

Neutron diffraction has been regarded by some workers as a supplement to x-ray methods, to be used chiefly for structure refinement or location of light x-ray scatterers among heavy scatterers. There are cases, however, where neutron methods should provide more direct approaches to an unknown structure from the outset. Although it has been stated that Fourier methods will not be possible with neutron data, it is here shown that it is demonstrated both experimentally and theoretically that this is not true in cases where such methods will really be advantageous; i.e., for structures where the atoms are for the most part not in special positions. (auth)

ELECTRICAL DISCHARGE

8092
ION CONCENTRATIONS AND RECOMBINATION IN EXPANDING LOW PRESSURE SPARKS. Richard G. Fowler, William R. Atkinson, and Luther W. Marks. Phys. Rev. 87, 966-70(1952) Sept. 15.

Passage of a capacitor discharge through a low-pressure gas between electrodes results in an abrupt expansion of the gas along any avenues open to it. In hydrogen, the expanding luminous gas shows strong Stark broadening. Applying this effect, ion concentrations have been measured ranging up to 30% of the initial particle concentration. Intensity measurements indicate that the quantized radiation is a result of electronic recombination. Time and space studies show that the ion concentration appears to reach a maximum at some remote position down the expansion avenue, but that all discharges reach a maximum at about the same time. (auth)

8093
THE THRESHOLD GAS PRESSURE REQUIRED TO SUSTAIN A STABLE ARC IN A MAGNETIC FIELD. N. L. Allen. Proc. Phys. Soc. (London) B65, 697-701(1952) Sept. 1.

Measurements of the minimum pressure required for the operation of stable, pulsed, high-current arcs in H_2 and air, in strong longitudinal magnetic fields, have been compared with earlier results obtained with He (Burhop et al., the Characteristics of Electrical Discharges in Magnetic Fields, New York, McGraw-Hill, (1949)). The values obtained are shown to be approximately those predicted by theoretical reasoning from the earlier work. Some relevant processes occurring in the discharge are discussed. (auth)

6094
RELIABILITY OF PROBE MEASUREMENTS IN HOT CATHODE GAS DIODES. Gottfried Wehner and Gustav Medicus. J. Applied Phys. 23, 1035-46(1952) Sept.

Experimental investigations show that Langmuir probe measurements can give quite erroneous results, due to work function changes of the probe, insulating layers on the probe surface, or different work functions at different places of the probe. The deposition of evaporated cathode compounds, the absorption of oxygen released from oxide cathodes, and the sputtering and evaporation from the probe may change the work function of a pure tungsten probe in time scales of seconds. In oxide cathode tubes especially, it is necessary to measure immediately after the probe has been thoroughly cleaned. An X–Y plotter, which recorded the whole probe characteristic in seconds, was found to be most suitable. No deviation from the Maxwellian velocity distribution of the plasma electrons could be found over a range of nearly four orders of magnitude in probe current, even in oxide cathode tubes under conditions where such deviations have been found by other authors. (auth)

6095
METHODS OF MEASURING THE PROPERTIES OF IONIZED GASES AT HIGH FREQUENCIES. III. MEASUREMENT OF DISCHARGE ADMITTANCE AND ELECTRON DENSITY. David J. Rose and Sanborn C. Brown. J. Applied Phys. 23, 1028-32(1952) Sept.

Experimental methods are given for determining the complex admittance and electron density of gas discharges by the use of microwave techniques. Applications are discussed where the discharge is contained in either high- or low-Q resonant cavities. (auth)

6096
DYNAMIC CHARACTERISTICS OF THE PLASMA IN DISCHARGES THROUGH RARE GASES. H. N. Olsen and W. S. Huxford. Phys. Rev. 87, 922-30(1952) Sept. 15.

The time variation of ion concentration in the plasma of flash discharges through Ne and A at low pressures has been determined from the Stark broadening of H_α and H_β lines. Hydrogen gas at about 1% of the total pressure was used for this purpose. A special method of oscilloscopic observation is employed. Analysis of the results explains differences in the time of appearance of various types of radiation in the discharge. A mechanism is proposed to account for the time variation of the intense continuum. (auth)

6097
AN ESTIMATE OF THE ENERGIES OF THE POSITIVE IONS IN A NEGATIVE POINT-TO-PLANE CORONA. G. L. Weissler and Mark Schindler. J. Applied Phys. 23, 844-6 (1952) Aug.

An attempt has been made to measure the energies with which positive ions arrive at the cathode of a negative point-to-plane corona in N_2. A hairpin thermocouple was used as the point electrode. It was heated by the corona current, and its thermal emf was recorded by a galvanometer. After appropriate calibration, the potential across the Crookes darkspace was determined to be about 300 v, and the average energy with which ions arrive at the corona point to be about 15 ev. (auth)

ELECTRONS

6098

THE EXCHANGE SCATTERING OF AN ELECTRON BY AN ATOM AND INVERSE AUGER EFFECT. Ta-You Wu. Phys. Rev. 87, 1012-15(1952) Sept. 15.

The theory of exchange scattering of an electron by an atom given by Mott and Massey is discussed. A new formulation of an approximate treatment of the problem is suggested that leads to a system of differential integral equations similar to the Fock equations for the discrete state of atoms. This method leads to Oppenheimer's result as a first approximation. The resonance scattering arising from the inverse process of auto-ionization (Auger effect) is treated in a phenomenological manner. (auth)

6099

SHADOW OF AN ELECTRON BEAM. H. M. Smith and S. Hansen. J. Applied Phys. 23, 1054-5(1953) Sept.

The shadow of a focused electron beam cast on a fluorescent screen exposed to a flood beam of electrons is illustrated.

6100

AN INTEGRABLE CASE OF ELECTRON MOTION IN ELECTRIC AND MAGNETIC FIELD. H. Poritsky and R. P. Jerrard. J. Applied Phys. 23, 928-30(1952) Aug.

Electron motion is studied in a two-dimensional electric field of potential $V = A + B(x^2 - y^2)/2$ and a uniform magnetic field $\overline{H} = (0,0,-H)$ normal to the electric field, where A, B, $-H$ are constants. The equipotential lines of the electric field in any plane z = const. consist of rectangular hyperbolas with a point of zero field strength at x = 0, y = 0. The differential equations of motion are integrated, and expressions are given for the electron paths. For this type of field, the electron motion consists of superposition of elliptic and hyperbolic motions, that is, of a simple harmonic motion along an ellipse whose center moves along a hyperbola. The latter hyperbolas intersect the equipotential hyperbolas, so that, unlike the uniform crossed field case, the electron may drift into regions of higher or lower potential. (auth)

6101

INTERACTION BETWEEN ELECTRON AND ONE-DIMENSIONAL ELECTROMAGNETIC FIELD. Nathan Rosen. Phys. Rev. 87, 940-2(1952) Sept. 15.

For a single electron interacting with the quantized transverse electromagnetic field it is found that, in the one-dimensional case, the Schroedinger equation can be put into a form like that of a system of coupled harmonic oscillators. From the classical frequencies of the normal modes of oscillation of such a system the quantal energy can be determined. While the perturbation method gives a logarithmic divergence in the interaction energy, one finds by the present method that the energy diverges like the square root of a logarithm. (auth)

GASES

6102

Rice Inst.

A QUANTUM MECHANICAL TREATMENT OF VIRIAL COEFFICIENTS, by John E. Kilpatrick. Rice Inst. and Los Alamos Scientific Lab. [nd] 17p. (AECU-2220; LADC-1262)

The virial equation of state for gases has been developed with the quantum-mechanical grand partition function as a basis, instead of with the usual Slater sum or the density matrix. Attention is thereby focused on the energy levels of systems of one, two, three, etc., molecules rather than on their wave functions. An explicit, closed solution has been found for the n^{th} virial coefficient in terms of the first n cluster integrals which is valid either classically or quantum mechanically. A simple generating function for the virial coefficients has been proposed. (auth)

6103

INTERMOLECULAR FORCE AND COEFFICIENT OF SELF-DIFFUSION. B. N. Srivastava and M. P. Madan. Phil. Mag. (7) 43, 968-75(1952) Sept.

In this paper the Chapman-Enskog theory of nonuniform gases, as applied to the phenomenon of self-diffusion, has been utilized to evaluate the intermolecular force constants. The collision integrals occurring in the Chapman-Enskog formula for self-diffusion, as evaluated by Hirschfelder, Bird, and Spotz by assuming the 12:6 power form of the Lennard-Jones potential function, have been used. The temperature variation of self-diffusion has been utilized to obtain the constant ϵ of the Lennard-Jones function, which represents the maximum negative energy of interaction of two molecules. The intermolecular separation r_0 for zero interaction energy occurring in the same potential function has been calculated by actual substitution. The recent data on self-diffusion as reported by Winn, Winter, and others have been used to obtain these constants and the values compared with those given by Hirschfelder et al. from viscosity and virial-coefficient data. (auth)

INSTRUMENTS

6104

Argonne National Lab.

AN ELECTROMAGNETIC ROD-POSITION INDICATOR, by Darwin Krucoff. June 1952. 13p. (ANL-4818)

For a sealed system where no mechanical penetration of the outer sealed shell is allowed and in which the control rods are shot free of the drive mechanism and into the system to provide over-flux protection, a means must be provided to index the rods when they are relatched to the drive mechanism. A continuous direct rod position measurement not being feasible, the electromagnetic detector described will provide a quite accurate fully inserted rod position indexing and show that the rod was moved from its fully inserted position when the rod drive is operated. (auth)

6105

Rochester Univ.

A MINIMAL NOISE PREAMPLIFIER FOR PROPORTIONAL COUNTERS AND SIMILAR APPLICATIONS, by K. Enslein and B. Brainerd. Aug. 22, 1952. 13p. (NYO-3224)

A minimal noise amplifier permitting the recognition of signals of 2 μvolts amplitude over a frequency range of 760 kc is described. The device is linear over an input range of 74 db and is compensated for power supply potential changes by means of negative feedback. (auth)

6106

Palmer Physical Lab., Princeton Univ.

STABILIZATION OF PHOTOMULTIPLIER TUBES, by R. Sherr and J. B. Gerhart. June 10, 1952. 10p. (NYO-3481)

Two methods for stabilizing output pulses from electrostatically focused photomultiplier tubes against supply-voltage fluctuations have been investigated. Both are useful with such multipliers as the RCA 5819 and the RCA C7151. The same stabilizing circuit is used in each method, the difference resulting from the point in the dynode system at which the circuit is introduced.

6107

A TIMING CIRCUIT FOR CONTROLLING RELATED HIGH ENERGY PULSES. K. S. W. Champion and N. L. Allen. Electronic Eng. 24, 423-5(1952) Sept.

As part of a technique for the investigation of high-energy gas discharges, an electronic timing circuit has been devised to control the operation of a group of heavier pulse circuits. This device should have wide application in problems where precise control of the sequence of operation of several

high-energy pulse circuits is required. (auth)

ISOTOPES

6108
MASS OF ATOMIC NUCLEI AND PERIODIC LAW. I. STABLE NUCLEI. E. S. Sarkisov. Zhur. Fiz. Khim. 25, 1415-26(1951) Dec. (In Russian)

The periodicity of isotopes is established on the basis of mass number, number of nucleons not connected in proton-neutron pairs, and total number of neutrons in the nucleus. A new periodic table of stable isotopes, ordered in large and small periods and four groups, is presented. The system shows the periodicity of the rare-earth elements without the need of a supplementary table.

6109
PRODUCTION AND SUPPLY OF MEDICALLY IMPORTANT RADIOISOTOPES. Henry Seligman. Brit. Med. Bull. 8, 253-5(1952).

The production and supply of Au^{198}, Br^{82}, C^{14}, Co^{60}, Fe^{59}, I^{131}, Ir^{192}, Na^{24}, P^{32}, and S^{35} for medical uses by the Isotope Division at Harwell and the Radiochemical Center at Amersham, England, are discussed.

ISOTOPE SEPARATION

6110
Carbide and Carbon Chemicals Co. (K-25)
ESTIMATING INTERSTAGE FLOW IN A SEPARATING CASCADE WITH A BYPASSING REFLUX STREAM, by J. Shacter. Issued Sept. 2, 1952. 12p. (K-943)

A test procedure is presented which evaluates average flows along with average separation factor of a uniform stagewise cascade section fractionating a binary mixture such as isotopes. The procedure calls for isotopic gradient measurements at the terminals of the isolated section on total reflux and also with at least one selected small rate of by-passing reflux stream. (auth)

6111
Yale Univ.
METHODS OF INCREASING THE EFFICIENCY OF THERMAL DIFFUSION COLUMNS, by W. W. Watson. [nd] 7p. (NYO-3020)

Experience with construction details and operation of thermal diffusion columns for isotope separation is cited and recommendations are made for the improvement of their efficiency.

6112
CONCENTRATION OF OXYGEN 18 BY CHEMICAL EXCHANGE. Worthy T. Boyd and Robert R. White. Ind. Eng. Chem. 44, 2202-11(1952) Sept.

The purpose of this investigation was to provide the process data necessary to construct and operate a unit for producing O^{18} by the exchange reaction between dissolved CO_2 and H_2O to which NH_3 has been added. The enriched CO_2 is withdrawn from the top of a packed reflux column and reduced with H_2 over a catalyst to form methane and H_2O, the latter being condensed and returned to the column as the reflux. The effect of NH_3 concentration, temperature, and pressure on the concentration of O^{18} and its rate of production was determined by measuring the rate of increase of concentration as a function of time and by measuring the final steady-state concentration. The results are given in terms of the separation factor or relative volatility and the height of column packing equivalent to an equilibrium stage.

MASS SPECTROGRAPHY

6113
FREE MOLECULAR FLOW IN THE SAMPLE INLET TO THE MASS SPECTROMETER. Paul D. Zemany. J. Applied Phys. 23, 924-7(1952) Aug.

The aspects of free molecular flow in the sample inlet to the mass spectrometer are pointed out and the conditions under which such flow can occur are described. Methods for calculating the leak diameter and sample pressure for various flow rates are developed. These principles are illustrated by consideration of the flow characteristics in the mass spectrometer leak detector, and by an example from reaction kinetic studies. The decrease in pressure in the sample reservoir is also described. This is applied to a determination of molecular weights. The effect of the pressure decrease on apparent fragmentation patterns is pointed out and a rational expression for spectrometer densitivity is suggested which is based on the fraction of molecules which flow through the spectrometer which appear as ions. (auth)

6114
CONVERSION OF HYDROGENIC MATERIALS TO HYDROGEN FOR ISOTOPIC ANALYSIS. Jacob Bigeleisen, M. L. Perlman, and H. C. Prosser. Anal. Chem. 24, 1356-7(1952) Aug.

Large memory effects are observed when H_2O from combustion of hydrogenous material is absorbed on the walls of combustion trains and vacuum systems associated with the mass spectrometer. These can be minimized by causing the material to react with hot U metal to produce pure H_2. The technique is illustrated.

MATHEMATICS

6115
National Bureau of Standards
STATISTICAL MATRIX TECHNIQUES AND THEIR APPLICATION TO THE DIRECTIONAL CORRELATION OR RADIATIONS, by U. Fano. [nd] 64p. (NBS-1214)

The geometry of nuclear states, i.e., their "spin polarization" is described by a suitable representation of the statistical matrix, similar to the description of partially polarized light by means of Stokes parameters. Relationships are established between the spin polarization of nuclei and the direction and polarization of the radiations which they emit or absorb. These developments serve to construct directly the formulas for the angular correlations of nuclear radiations and of disintegration products. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

6116
Atomic Energy Research Establishment, Harwell, Berks (England)
A PRECISION PRESELECTING BACK-REFLECTION MICROBEAM X-RAY CAMERA, by R. W. Cahn. July 4, 1952. 10p. (AERE M/R-774)

The need for the camera is described, and the choice of the method of preselecting the area to be irradiated discussed. A specimen stage with two perpendicular micrometer-controlled motions may be removed from the camera, and fitted onto the table of a Vickers Projection microscope. Using the micrometer scales, the coordinates of the part of the specimen to be irradiated are found with reference to a small hole in a piece of platinum foil. On the return of the stage to the camera, the hole in the platinum foil is positioned in the beam by means of an x-ray-sensitive electronic counter. The desired part of the specimens is then positioned for irradiation by resetting the coordinates. Conical-bore lead-glass collimators were found to be the most suitable. The construction of the camera is described in some detail. (auth)

6117
Argonne National Lab.
A COMPACT NEUTRON-SENSITIVE THERMOPILE, by A. C. Lapsley. June 26, 1952. 9p. (ANL-4869)

A special neutron-sensitive thermopile has been developed. It is both compact and watertight. Its output is one millivolt at 10^{11} neutron flux and it is quite linear at least to a flux of 3×10^{12}. At 10^{13} flux, burnout will lower its sensitivity in the order of 1% in 100 days. The unit is commercially available. (auth)

6118

Brookhaven National Lab.

GRAY WEDGE PULSE HEIGHT ANALYSIS, by W. Bernstein, R. L. Chase, and A. W. Schardt. [nd] 24p. (BNL-1220)

A photographic method of pulse height analysis equivalent in performance to a 50-channel electronic analyzer is described. The basic principle is that pulses from the spectrometer amplifier are stretched and then displayed upon the screen of an oscilloscope and photographed through a gray wedge. The experimental error in the determination of counting rates is 5% and absolute activity calibration is easily made. The instrument is compact, semi-portable, inexpensive, and easy to maintain. (auth)

6119

Brookhaven National Lab.

A SLOW NEUTRON DETECTOR, by David E. Alburger. Aug. 14, 1952. 2p. (BNL-1233)

A finely divided mixture of B_2O_3, enriched in B^{10}, and silver activated zinc sulfide (RCA Phosphor number 33-A-20A) has been used in conjunction with a 5819 photomultiplier tube to detect thermal neutrons. B_2O_3 which had been ground so as to pass through a 400 mesh sieve was interspersed in the ZnS by passing the mixture through a 270 mesh sieve several times. The powder mixture was spread uniformly on the face of the 5819 and held in place by means of an aluminum reflector foil and a piece of rubber dental dam stretched over the end of the tube. The efficiency for detecting thermal neutrons was studied as a function of mixture ratio and layer thickness using a collimated beam from the Brookhaven reactor. An efficiency of 30 percent was obtained when the $ZnS : B_2O_3$ ratio was 5:1 by weight and when the surface density of the mixture was about 70 mg/cm^2. To achieve the optimum efficiency requires that pulses down close to the photo tube noise level are observed which is possible only if the voltage is sufficiently high so that the 5819 noise stands well above the amplifier noise. At very low discriminator settings, false counts will be produced by the "ringing" effect due to large pulses unless the amplifier is of the non-overload type. If a mere conventional amplifier is used and if its discriminator is set high enough to avoid false counts then the efficiency will be 20 percent or less. A very low sensitivity to gamma-rays was demonstrated by exposing the detector to a Co^{60} source. The discrimination against gamma-radiation was comparable to that observed by Hornyak (W. F. Hornyak, Rev. Sci. Instruments 23, 264(1952)) in his tests of a fast neutron detector. Although the thermal neutron efficiency of this detector is less favorable than that obtainable with a BF_3 counter, the device may be advantageous in some applications because of its small size and simplicity. If a 5819 setup is already in use with various scintillators for beta, gamma, alpha and fast neutron detection, the $ZnS-B_2O_3$ powder allows thermal neutrons to be detected in addition. Also, as shown by Hornyak, the pulses from ZnS can be used in experiments requiring a resolving time as short as 5×10^{-8} sec. It is not known whether the present powder mixture is similar to General Electric thermal neutron phosphor cat. no. 9776095G4. The latter is used in units which are claimed by G. E. to be 25 percent efficient for thermal neutrons but the composition of the material has not been made public. Miss Elizabeth prepared the B_2O_3 from elemental boron (Isotopes Division, AEC, Oak Ridge, Tenn.) enriched to 96 percent B^{10}. (Entire report)

6120

Brookhaven National Lab.

DETECTION OF FISSION NEUTRONS, by David E. Alburger. [nd] 4p. (BNL-1234)

A disk of U, enriched to over 90% U^{235} and thick enough to absorb completely all incident thermal neutrons, was placed immediately in front of the ZnS-lucite molded button of the Hornyak detector. The experiments were carried out using a collimated beam from the Brookhaven reactor. Curves are shown of the integral pulse height spectrum due to fission neutrons observed with the reactor beam incident on the U. When Cd is inserted in the beam the yield drops by a factor of about 50 to a curve which was found to be the sum of fissions induced by neutrons not stopped by the Cd and fast pile neutrons detected by the Hornyak buttons.

6121

Hanford Works

PRECISION ALPHA COUNTING – THE EFFECT OF HIGH BETA BACKGROUNDS, by D. G. Miller and M. B. Leboeuf. Aug. 1, 1952. 20p. (HW-25210)

The presence of greater than approximately 3×10^7 disintegrations/min beta activity in a source for which the alpha activity is to be determined results in a reduction in observed alpha counting rate on using the Alpha Simpson Proportional Counter. At the normal operating voltage for this instrument, i.e., approximately 200 volts below the beta threshold for a given beta intensity, the reduction in alpha counting rate varies from approximately 0.5% at 3×10^7 d/min beta to about 2% at 4×10^8 d/min beta. The magnitude of the reduction is a function of the beta intensity, operating voltage, beta energy, alpha pulse-amplitude distribution, input amplitude threshold, and individual instrument circuit characteristics. (auth)

6122

Polaroid Corp.

INTERIM DEVELOPMENT REPORT FOR PHOSPHATE GLASS GAMMA-RADIATION DOSIMETER [FOR] PERIOD JULY 1 THROUGH JULY 31, 1952. Aug. 15, 1952. 33p. (NP-4027; U-22719)

Progress in finding and controlling various residual sources of error sometimes found in laboratory-type readers for the phosphate-glass dosimeter is reported. New fluorescent standards for the readers were issued. A more detailed operating manual entitled "Special Manual for the High Precision Laboratory-Type Reader CP-95(XN-3)/PD" and dated July 8, 1952, is attached as an appendix.

6123

Department of Mines and Technical Surveys (Canada)

THE USE OF GEIGER-MUELLER TUBES FOR THE DETERMINATION OF THE STATE OF EQUILIBRIUM OF THE RADIOELEMENTS IN URANIUM ORES, by Christian Lapointe. Aug. 6, 1952. 24p. (NP-4080; TR-101/52)

The results of routine determination of U in ores, concentrates, and tailings by the use of G-M counters have not compared favorably with those arrived at by chemical methods, mainly because the milling processes disturb the radioactive equilibrium normally existing between the U and Ra families. Loss of Rn is the principle source of error. Since both U and Ra families contribute ~50% of the β activity, while only the Ra family emits a hard γ ray, the state of equilibrium can be determined readily by measuring the β/γ ratio. Necessary corrections are discussed, as well as application of knowledge of the equilibrium state to estimation of U.

6124

Palmer Physical Lab., Princeton Univ.

A FAST NEUTRON SCINTILLATION SPECTROMETER, by R. F. Mozley and F. C. Shoemaker. May 12, 1952. 5p. (NYO-3476)

A proton recoil counter is described for examining neutron

groups in the energy range from 2 to 18 Mev. Two anthracene crystals are mounted in such a way that the first crystal is the source of protons while the second defines the angle of proton recoil. The pulses from both scintillation counters are added together to give the energy of the recoil proton and thus the neutron energy. The instrument was tested by observing the pulse-height spectrum from $Li^7(p,n)Be^7$ neutrons at 45° to the direction of the incident 18.2-Mev proton beam.

6125
LUMINESCENCE OF ALKALINE IODIDES. J. Bonanomi and J. Rossel. Physica 18, 486-8(1952) June-July. (In French)

The luminescence of LiI, NaI, KI, RbI, and CsI phosphors, with and without Tl activation, was studied over the temperature range 77 to 300°K with a scintillation counter. Excitation was by α or γ irradiation. Luminescence decay, variation of activation with temperature, glow curves, and yields are correlated with a monomolecular luminescent center model.

6126
TRANSFER AND TRANSPORT OF ENERGY BY RESONANCE PROCESSES IN LUMINESCENT SOLIDS. II. TRANSFER AND TRANSPORT OF ENERGY IN SENSITIZED SYSTEMS; EXCITATION IN THE SENSITIZER. P. J. Botden. Philips Research Repts. 7, 197-235(1952) June.

From experiments carried out on $Ca_3(PO_4)_2$-Ce-Mn, $Sr_3(PO_4)_2$-Sn-Mn, $3Ca_3(PO_4)_2 \cdot CaF_2$-Sb-Mn, $Ca_2P_2O_7$-Sn-Mn, and $Mg_2P_2O_7$-Ce-Th-Mn it is proved that the ratio of the efficiencies of activator to sensitizer fluorescence increases with increasing sensitizer concentration at constant activator content. These results are in contradiction with present theory. An explanation of the phenomena of sensitization in solids is given on the basis of the assumptions that (a) around a sensitizer k cation sites are found such that excitation energy is transferred from the sensitizer to an activator ion, if this ion is situated on one of the k sites; (b) when no activators are found on the k sites around an excited sensitizer the energy may reach an activator through energy transport via other sensitizers, l sites being available for energy transfer from the excited sensitizer to another one, situated on one of the l sites. Transfer of energy from a sensitizer both to an activator and to another sensitizer takes place through resonance processes. Starting from the model of Mott and Seitz it is possible to give a schematic picture of the energy transfer in sensitized phosphors and of the temperature dependence of the efficiency of energy transfer. The observed temperature dependence in $Ca_3(PO_4)_2$-Ce-Mn can be explained by assuming that the temperature-dependent part of the efficiency of energy transfer is due to energy transport from an excited Ce via other Ce ions to a Mn ion. 68 references.

6127
CONTINUOUS AIR MONITOR. T. H. Mansfield. Nucleonics 10, No. 9, 55(1952) Sept.

To provide a record of airborne particulate radioactivity, a continuous air monitor has been designed that counts the activity almost immediately after the dust is deposited on a moving strip of filter paper. A dual-channel system utilizing two detectors and two counting-rate circuits feeding a strip chart recorder makes it possible to record both the α and β activities simultaneously. With this apparatus, response times as short as 2 or 3 min and sensitivities of about 1/10 allowable concentrations of radioactive dusts are obtainable, but the ultimate of both characteristics cannot be achieved at the same time.

6128
GENERAL PRINCIPLES OF ASSAY AND STANDARDIZATION OF RADIOACTIVE ISOTOPES. L. H. Gray. Brit. Med. Bull. 8, 115-24(1952).

Topics discussed in detail include randomness of the disintegration process as an ultimate limit upon accuracy of assay, assay of a β-emitting isotope relative to a standard sample of the same isotope, measurement of γ radiation, quantitative interpretation of the performance of ion chambers and counters exposed to γ radiation, the absolute determination of disintegration rates, the absolute determination of the rate of emission of γ-ray energy from isotopes having known γ-ray spectra, and the absolute determination of the rate of emission of β-ray energy.

6129
COUNTERS AND ION CHAMBERS FOR THE DETECTION AND MEASUREMENT OF RADIOACTIVE ISOTOPES. N. Veall. Brit. Med. Bull. 8, 124-31(1952).

The principles of operation of gas-filled radiation detectors such as ionization chambers, proportional counters and Geiger-Mueller counters, the design and operation of ion chambers and counter tubes for β and for γ-ray counters, scintillation and scintillation Geiger counters are discussed.

6130
PULSE-AMPLITUDE ANALYSIS IN NUCLEAR RESEARCH. III. MULTICHANNEL ANALYZERS. A. B. Van Rennes. Nucleonics 10, No. 9, 32-8(1952) Sept.

Circuit diagrams and descriptions are presented for pulse analyzers in which pulse-height selection is accomplished by mechanical means, thermionic diodes, trigger circuits, sorting-ladder circuits, and beam-deflection techniques.

6131
NEUTRON ENERGY MEASUREMENTS WITH A HELIUM 3 FILLED PROPORTIONAL COUNTER. R. Batchelor. Proc. Phys. Soc. (London) A65, 674-5(1952) Aug. 1.

The most suitable nuclear transformation for measuring neutron energies below 1 Mev (suitable in the sense that a specific energy release corresponds to a specific neutron energy) is $He^3(n,p)T$. A proportional counter containing 5.4 cm of He (10% He^3) and 110 cm of Xe was constructed. Pulse-height distributions for thermal and 560-kev neutrons are illustrated.

MESONS

6132
Microwave Lab., Stanford Univ.
PSEUDOSCALAR MESONS WITH APPLICATIONS TO MESON-NUCLEON SCATTERING AND PHOTOPRODUCTION, by S. D. Drell and E. M. Henley. Aug. 1952. 42p. (ML-165)

The scattering of π^+ and π^- mesons by protons and the production of π^+ mesons by gamma rays incident on protons is studied with the quantized theory of pseudoscalar mesons with pseudoscalar coupling. The Dyson transformation is applied to the hamiltonian to yield a new representation in which the velocity-independent aspects of the nucleon dynamics are more readily identified. A large "core" term appears in the meson-nucleon interaction in this representation and is incorporated into the zero-order hamiltonian. The remaining interaction terms are treated perturbation-wise or according to the Heitler damping procedure. It is found that even after separating out the large core term this method of approach fails to give agreement between theory and experiment. It does, however, improve on the results of the straight perturbation approximation and brings the theory in closer accord with the observations. It is suggested that a direct test of the role of the core term is possible in the process of double meson production by gamma rays incident on protons. (auth)

6133
Rochester Univ.
COULOMB EFFECTS IN PION SCATTERING BY PROTONS UNDER THE CHARGE INDEPENDENCE HYPOTHESIS, by Leon Van Hove. Aug. 20, 1952. 23p. (NYO-3223)

The effect of coulomb forces on the scattering of π mesons by protons is evaluated under the assumption of charge independence for the nonelectromagnetic part of the interaction.

6134
Rochester Univ.
PHOTOPRODUCTION OF π^0-MESONS IN HYDROGEN AND DEUTERIUM, by Norman C. Francis. Sept. 4, 1952. 34p. (NYO-3225)

Photoproduction of π^0 mesons in H_2 and D_2 is calculated in the weak coupling theory under several different assumptions regarding the interaction hamiltonian. All calculations are performed non-relativisitically taking into account the anomalous magnetic moments of the nucleons. The contribution of the negative energy states for the nucleons and of the nucleon current are isolated. Calculations are also performed with a phenomenological hamiltonian which yields a $(2 + 3 \sin\theta')$ angular distribution in the center of mass system for the photoproduction of π^0 mesons in H_2. In the case of D_2, the relative importance of elastic and inelastic photoproduction is examined as a function of photon energy and meson angle, and the theoretical results are compared with recent experimental data. Best agreement with experiment is obtained if nucleon current effects are neglected. (auth)

6135
THE NATURE OF THE NEUTRAL π-MESON. E. A. Power. Proc. Phys. Soc. (London) A65, 670-1(1952) Aug. 1.

The possibility of determining the relative sign of coupling, or indirectly of the parity, of the π^0 meson from the reaction $n + p = \pi^0 + d$ is considered.

6136
ON THE PRODUCTION OF κ-MESONS. U. Haber-Schaim and G. Yekutieli. Phil. Mag. (7) 43, 997-8(1952) Sept.

Calculations of the ratio of κ to π mesons produced in nucleon-nucleon collision favor the assumption that the κ meson is a Yukawa particle which interacts with the nucleon through a "kapponic charge" independently of the existence of the "pionic charge."

6137
A NOTE ON THE MEASUREMENT OF LIFETIME OF UNSTABLE PARTICLES. J. G. Wilson and C. C. Butler. Phil. Mag. (7) 43, 993-5(1952) Sept.

A procedure is described by which observations on cloud-chamber photographs of charged ($V^{\pm}$,τ) or uncharged ($V^0_{1,2}$) particles should be reported in order that data obtained by one group may be combined with those of others in a straightforward manner.

6138
THE TRANSVERSE MOMENTUM SPECTRUM OF THE DECAY PRODUCTS OF CHARGED V-PARTICLES. Carl M. York. Phil. Mag. (7) 43, 985-90(1952) Sept.

The momentum distributions in the center-of-mass system for the charged secondary from the two reactions $V^{\pm} \rightarrow \mu^{\pm} + \pi^0 + \nu$ and $V^{\pm} \rightarrow \mu^{\pm} + \nu + \nu$ have been calculated. The second of the above processes has been used to calculate the transverse momentum spectrum of the charged secondaries. This has been compared with the measured spectrum from charged V particles and found to be consistent with it. It is not possible to distinguish between the two decay schemes by a study of the momentum distributions, but alternative methods of distinguishing between them are discussed. (auth)

6139
NUCLEAR CROSS SECTIONS FOR NEGATIVE PIONS OF ENERGY 113 AND 137 MEV. Ronald L. Martin. Phys. Rev. 87, 1052-60(1952) Sept. 15.

The measurements of the nuclear cross sections for negative pions at 85 Mev, recently made by Chedester et al. (Phys. Rev. 82, 958(1951)), have been extended to 113 and 137 Mev. The total-absorption plus inelastic-scattering cross sections were obtained from a transmission measurement in poor geometry. The cross sections are all close to the geometrical value, $\pi A^{2/3}(\hbar/\mu c)^2$, within the accuracy (15%) of this technique. With the possible exception of carbon there is no evident energy dependence in the range 85 to 137 Mev. (auth)

6140
AN APPLICATION OF THE THEORY OF THE EFFECTIVE RANGE TO MESON-NUCLEON SCATTERING. Keith A. Brueckner. Phys. Rev. 87, 1026-30(1952) Sept. 15.

A theory of the effective range for P-state scattering is developed and the extent of its validity is investigated. It is found that a parameter of the theory can meaningfully be identified as an effective range and that the energy dependence of the effective range is very weak. The resulting formula for the energy dependence of the phase shift is shown to be exactly equivalent, if the relativistic energy is used, to a simple form of the Wigner-Eisenbud one-level formula for P states in which the level shift is neglected. An application to meson-nucleon scattering is made which illustrates the use of the method and which suggests a high-lying resonance in the scattering. (auth)

6141
SURFACE PRODUCTION OF CHARGED MESONS BY PHOTONS ON NUCLEI. S. T. Butler. Phys. Rev. 87, 1117-24 (1952) Sept. 15.

An estimate has been made of the photoproduction cross section of charged mesons from nuclei, and in particular from "surface-nucleons," i.e., the weakly interacting nucleons which make up the less dense nucleon atmosphere surrounding the main body of a nucleus. Comparison with experiment indicates that the production of mesons from the core of a nucleus is appreciably suppressed, apart from the effects of the initial momentum distribution of the nucleus, and of meson absorption. It is found, for example, that apart from having the correct $A^{2/3}$ dependence for the $\pi^+ + \pi^-$ cross section, the surface production alone can account for large fractions of the observed yields, and because of differences in average binding between neutrons and protons in nuclei, gives π^-/π^+ ratios which have the same trends as a function of A as the observed ratios. A possible explanation of these results is that there occurs a large competing photodisintegration process as a result of meson exchange effects between strongly coupled nucleons in the interior of a nucleus. (auth)

6142
μ-MESON CAPTURE AND NUCLEAR SHELL STRUCTURE. James M. Kennedy. Phys. Rev. 87, 953-8(1952) Sept. 15.

The rate of absorption of negative μ mesons in Pb and in Ca is calculated, using an interaction of the charge-exchange type described by Wheeler. A shell model of the nucleus is used in making explicit calculations of the various nuclear matrix elements. The ratio of the absorption rate in Pb to that in Ca is found to be 6.1, in contrast to the value 14.3 predicted by the simpler Wheeler theory. Another result is that the absorption rate in Hg should be greater than that in Pb by 20% in spite of its smaller atomic number. These results are in fair agreement with recent experimental measurements. The coupling constant for the charge-exchange reaction is $g \approx 3 \times 10^{-49}$ erg-cm^3, approximately the same as the coupling constants for β decay and μ decay. (auth)

6143
CAPTURE OF μ-MESONS IN HEAVY ELEMENTS. J. W. Keuffel, F. B. Harrison, T. N. K. Godfrey, and George T. Reynolds. Phys. Rev. 87, 942-52(1952) Sept. 15.

Measurements have been made of the mean lifetimes of μ mesons in several heavy elements. Time-lags between the arrival of a cosmic-ray meson in the target and its subsequent absorption—as signaled by the neutrons and gamma rays following capture—are measured using large liquid

scintillation counters and a chronotron timing circuit. The timing uncertainty is about 2×10^{-9} sec, and the counting rates are such that a mean life can be determined to an accuracy of 10% in about a week's run at sea level. A short-lived component of the decay curves was found and identified as due to neutrons from proton-induced stars. Errors from this effect were avoided. Our latest results for the mean lives, in μsec, are Fe, 163 ± 27; Hg, 58 ± 4; Cu, 116 ± 9; Pb, 76 ± 4; Sb, 99 ± 11; and Bi, 68 ± 5. The results are in agreement with the Wheeler Z^4_{eff} law up through Cu but disagree by a factor 3 for the heavier elements. They are in reasonable agreement with Kennedy's calculations (Phys. Rev. 87, 953(1952)). The difference between the mean lives for Hg and Pb is also qualitatively predicted by Kennedy on the basis of a shell model of the nucleus. The results, together with Kennedy's calculation for Pb, allow the conclusion that the μ-meson–nucleon coupling constant has the same value, within about 25%, as recent values of the coupling constants of β decay and of the spontaneous disintegration of the μ meson. (auth)

MOLECULAR PROPERTIES

6144

Brookhaven National Lab.

VIBRATIONAL FREQUENCIES OF PHOSPHINE-d AND PHOSPHINE-d_2, by Ralph E. Weston, Jr. and Marshall H. Sirvetz. [nd] 5p. (BNL-1229)

The vibrational frequencies of PH_2D and PHD_2 were calculated by use of a suitable model, and these frequencies were compared with the adsorption bands which could be observed and assigned. The modified valence force model was found to be well suited to calculations for phosphine, giving a maximum deviation in observed and calculated values of about 1%.

NUCLEAR PHYSICS

6145

Oak Ridge School of Reactor Tech.

A LABORATORY COURSE IN REACTOR PHYSICS PRESENTED IN THE 1951-1952 SESSION OF THE OAK RIDGE SCHOOL OF REACTOR TECHNOLOGY. Aug. 11, 1952. 155p. (AECU-2164)

Twenty-six experiments performed in the reactor physics laboratory course of the Oak Ridge School of Reactor Technology are outlined. The first part of the course is designed to acquaint the engineers with the fundamentals of nuclear and health physics. The later work is then concerned with experiments of direct relevance to reactor engineering. The laboratory course is taught concurrently with lecture courses in nuclear physics and other subjects which are designed to present the fundamental physical principles upon which the laboratory experiments are based.

6146

Rochester Univ.

THEOREMS ON COMPLEMENTARY CONFIGURATIONS, by A. M. L. Messiah. July 1952. 8p. (NYO-3212)

Complementary configurations are defined as configurations of the shell-model nucleus differing only by the numbers of nucleons in their unfilled shell if the sum of these numbers is the number of individual states associated with this unfilled shell. Complementary spaces and operators are defined, and theorems on properties of one-particle and two-particle operators are presented. The theorems are applied to determination of properties of charge-independent central potentials for the various exchange forces.

6147

NON-ADDITIVITY OF NUCLEON MAGNETIC MOMENT IN THE DEUTERON. Hironari Miyazawa. Progress Theoret. Phys. (Japan) 7, 207-16(1952) Feb.

The modification of a nucleon's anomalous magnetic moment by the proximity of another nucleon has been estimated by employing the pseudoscalar meson theory. Contribution of this effect to the deuteron magnetic moment turns out to be of the order of $\sim 0.12|U|/\kappa$, where κ means the rest energy of pion and U the potential energy of the deuteron (~14 Mev). The precise prediction of this value is impossible because of the lack of any satisfactory form of meson theory. The main conclusion reached is that the magnetic moment of the deuteron does not determine the fraction of D-state mixture. Including the effect of relativistic correction (which induces the uncertainty of ~1.5%), the D-state percentage of the deuteron would be from 2 to 8% or more. (auth)

6148

A REMARK RELATIVE TO ENERGY LEVELS OF LIGHT NUCLEI. Félix Joachim Wiśniewski. Compt. rend. 235, 364-5(1952) Aug. 4. (In French)

Certain experimentally determined energy levels of light nuclei are shown to satisfy the relation $E = Kn(n+1)$, where n is a whole number and K is a numerical constant. The levels are therefore levels of rotation. K has two different values for both B^{10} and C^{13} corresponding to two series of terms. The existence of two kinds of nuclei for each of these nuclides is concluded.

NUCLEAR PROPERTIES

6149

Brookhaven National Lab.

THE BETA DECAY OF F^{20}, by David E. Alburger. July 21, 1952. 19p. (BNL-1231)

The β decay of F^{20} has been investigated with a lens spectrometer using sources activated by the $F^{19}(d,p)F^{20}$ reaction. A simple β-ray spectrum of allowed shape is observed having an end-point energy of 5.406 ± 0.017 Mev. Beta emission is followed by a 1.631 ± 0.006-Mev γ ray from an excited state of Ne^{20}. The γ-ray energy was checked by comparing with the Sb^{124} γ ray, measured as 1.692 ± 0.005 Mev, and by failure to observe photoneutrons from Be. Beta-ray branching to the ground state of Ne^{20}, if present, has a relative intensity of less than 1%. The total F^{20} disintegration energy, 7.038 ± 0.018 Mev, is used together with other nuclear data to derive a Ne^{20} mass which is independent of mass spectrographic measurements. The result, Ne^{20} = 19.998794 ± 0.000026 amu, is in agreement with mass spectrographic values. (auth)

6150

Brookhaven National Lab.

NUCLEAR SPIN OF V^{50} BY PARAMAGNETIC RESONANCE, by C. Kikuchi, M. H. Sirvetz and V. W. Cohen. [nd] 4p. (BNL-1236)

The paramagnetic resonance absorption spectrum of a Tutton salt of V, enriched to 22.83% of V^{50}, was investigated. Evidence was found that the spin of V^{50} is 6, in contradiction to Nordheim's rule which predicts a spin of about 7.

6151

Yale Univ.

THE MASS OF Cl^{39} AND OF A^{39}, by C. E. Anderson, G. W. Wheeler and W. W. Watson. July 8, 1952. 2p. (NYO-3022)

Recently we have searched for the ground state proton group from the nuclear reaction $A^{38}(d,p)A^{39}$, using argon analyzing 1.2 percent A^{36}, 1.2 percent A^{38}, and 97.6 percent A^{40}. We have not observed this group, but we would have if its Q value is greater than 5 Mev which would make its range longer than that of the first excited state proton group (Zucker and Watson (Phys. Rev. 80, 966(1950)) from A^{37}. At shorter ranges weak proton groups from this argon gas target are obscured by the strong groups from A^{41} and A^{37}. We have also looked for gamma rays in coincidence with the decay of A^{39} but could find none. Therefore, using the mass of K^{39} as 38.97606 ± 3 (Collins, Nier, and Johnson (Phys.

Rev. 84, 717(1951)) and E_{max} for the beta decay of A^{39} as 0.565 ± 0.005 Mev (Brosi, Zeldes, and Ketelle (Phys. Rev. 79, 902(1950)) one obtains 38.97667 ± 4 for the mass of A^{39}. This value for the mass of A^{39} yields a Q value for the A^{38} (d,p)A^{39} reaction of 4.31 Mev which we would not be able to observe. From this mass of A^{39} we can calculate the mass of Cl^{39}, using the value of the total disintegration energy of $Cl^{39}-A^{39}$ as 3.31 ± 0.09 Mev (Haslam, Katz, Moody, and Skarsgard (Phys. Rev. 80, 318(1950)). This gives 38.98022 ± 13 for the mass of Cl^{39} which differs both from the value 38.97871 ± 10 given by Wilkinson and Carver (Phys. Rev. 83, 466(1951)), and also from that given by Haslam et al., 38.9826. If we were to start with Wilkinson and Carver's value for the mass of Cl^{39}, we obtain 38.97516 for the mass of A^{39}, and the Q value for the (d,p) reaction would be 5.92 Mev. Then we would have observed this proton group. Also this 38.97516 value for the mass of A^{39} is less than that of K^{39}, in contradiction to the observed β decay. And, finally, the mass of Cl^{39} given by Haslam et al. leads to the prediction that the total disintegration energy for $A^{39}-K^{39}$ is 2.8 Mev, which is also in contradiction to the observed β-ray energy. (Entire Report)

6152

Palmer Physical Lab., Princeton Univ.

A NOTE ON THE COSINE INTERACTION BETWEEN NUCLEONS, by A. de Shalit. [nd] 4p. (NYO-3477)

This material appeared in Phys. Rev. 87, 843(1952) and was abstracted in Nuclear Science Abstracts as NSA 6-5865.

6153

HYPERFINE STRUCTURE IN NEODYMIUM ETHYL SULPHATE. B. Bleaney, H. E. D. Scovil, and R. S. Trenam. Phil. Mag. (7) 43, 995-7(1952) Sept.

Parameters of the usual paramagnetic resonance hamiltonian have been evaluated for Nd^{143} and Nd^{145} by measurements of the strong-field spectrum of Nd ethyl sulfate at 3-cm wavelength. The validities of various literature values for the nuclear magnetic moments are discussed.

6154

PARAMAGNETIC RESONANCE IN PRASEODYMIUM ETHYLSULPHATE. B. Bleaney and H. E. D. Scovil. Phil. Mag. (7) 43, 999-1000(1952) Sept.

The paramagnetic resonance spectrum of Pr ethyl sulfate in a crystal diluted with La has been observed at 20°K, using radiation of wave numbers 0.332, 0.687, and 0.789 cm^{-1}. A single electronic transition was observed, with a hyperfine structure of six equally spaced components. This confirms the known nuclear spin (5/2) of the only stable isotope, 141. The nature of the interaction hamiltonian is discussed.

6155

THE NUCLEAR ELECTRIC QUADRUPOLE MOMENT OF ERBIUM 167. G. S. Bogle, H. J. Duffus, and H. E. D. Scovil. Proc. Phys. Soc. (London) A65, 760-1(1952) Sept. 1.

Recent measurements by Bleaney and Scovil (NSA 5-5855) of the paramagnetic resonance of Er ethyl sulfate diluted with La ethyl sulfate have been extended to 4°K at 3 cm wavelength. It has been possible to resolve the spectrum completely in all directions and to give more accurate values to the hamiltonian parameters. The nuclear electric quadrupole moment Q is found to be $|Q| = 10.2 \pm 3 \times 10^{-24}$ cm^2.

6156

EXCITED STATES OF LITHIUM-6 AND LITHIUM-7. W. Franzen and J. G. Likely. Phys. Rev. 87, 667-8(1952) Aug. 15.

An abstract of this material was indexed as NYO-3008 and appears in Nuclear Science Abstracts as NSA 6-3673. A slight variation exists between the numerical values stated in the two papers.

6157

INTERACTION MOMENT CONTRIBUTIONS TO MAGNETIC MOMENTS OF NUCLEI. Arnold Russek and Larry Spruch. Phys. Rev. 87, 1111-17(1952) Sept. 15.

A model of a heavy odd-A nucleus is used in which the outer nucleon is in the state predicted by the Mayer scheme, and the core is in a state of zero angular momentum. It is found that the general trend of the deviations of the experimentally determined magnetic moments from the Schmidt curves is describable in terms of a linear combination of the three phenomenological interaction moment operators which can arise from a charge exchange potential in a second-order meson calculation. The final expression for the interaction moment, matched to the data, is, by and large, independent of any detailed properties of the radial functions associated with these operators, of the radial function of the outer nucleon, and, except for a dependence on the relative number of neutrons and protons in the core, of the core structure. The consequent predictions that, for given l and j, the interaction moments of heavy odd-neutron nuclei should be smaller in magnitude than those of heavy odd-proton nuclei and that the addition of two protons to an odd-proton nucleus or of two neutrons to an odd-neutron nucleus should push the moments toward the Schmidt curves are in general accord with the data. Odd-odd nuclei are also considered. (auth)

6158

HYPERFINE STRUCTURE IN THE SPECTRA OF IRIDIUM AND OSMIUM. Kiyoshi Murakawa and Shigeki Suwa. Phys. Rev. 87, 1048-9(1952) Sept. 15.

The hyperfine structure in the spectra of Ir I and Os I was studied and the following results were obtained. Both Ir^{191} and Ir^{193} have nuclear spins 3/2, and the ratio of their magnetic moments is $\mu^{193}/\mu^{191} = 1.04 \pm 0.04$, with $\mu^{193} = +0.17 \pm 0.03$ n.m. Their quadrupole moments are given by $Q^{193} = (+1.0 \pm 0.5) \times 10^{-24}$ cm^2 and $Q^{191}/Q^{193} = 1.2 \pm 0.4$. Lines due to the transition $d^7s^2-d^7sp$ were observed to have an isotope displacement effect of the order of 0.063–0.071 cm^{-1}. Os^{189} has a nuclear spin 3/2, a nuclear magnetic moment +0.70 ± 0.09 n.m., and a quadrupole moment $(+2.0 \pm 0.8) \times 10^{-24}$ cm^2. (auth)

NUCLEAR TRANSFORMATION

6159

THE DIFFERENTIAL CROSS SECTION FOR THE SCATTERING OF 9.48-MEV PROTONS BY HELIUM. T. M. Putnam. Phys. Rev. 87, 932-40(1952) Sept. 15. (cf. NSA 5-6457)

The angular distribution of protons scattered by He has been measured at 9.48-Mev incident proton energy in the angular range 10 to 172.5° (Lab.) Ilford C-2 photographic emulsions were used for detecting the scattered particles. The geometry of the multiplate scattering chamber and the accuracy of the construction was such that the results obtained have a relative accuracy within the counting statistics and an absolute accuracy to ±3%. The results are given in terms of the differential cross section per unit solid angle in the center-of-mass system and are compared to the results at other energies. (auth)

6160

RADIATIVE CAPTURE OF THERMAL NEUTRONS BY Cd^{113}. R. W. Pringle, H. W. Taylor, and K. I. Roulston. Phys. Rev. 87, 1017-18(1952) Sept. 15.

Study of the radiative capture of thermal neutrons by Cd^{113} with a scintillation spectrometer gave 9.20 Mev as the neutron binding energy of Cd^{114}, and nuclear levels at 0.57, 1.33, 2.63, 3.49, 4.03, and 4.43 Mev. The relationship between the resolution of the spectrometer and γ-ray energy is shown. (auth)

6161
A DETERMINATION OF THE DOPPLER EFFECT FOR GAMMA-RAYS OF 4.5 AND 4.8 MEV. G. A. Jones and D. H. Wilkinson. Phil. Mag. (7) 43, 958-63(1952) Sept.

The Doppler effect has been observed for the γ rays of 4.5 and 4.8 Mev emitted in cascade when α particles of 958 kev are captured in Li^7. The γ rays are detected in a NaI(Tl) crystal placed successively in forward and backward directions from the Li target; the observed shift in energy between the two directions is $1.15 \pm 0.12\%$ and the theoretical first-order Doppler shift is 1.30%. It is remarked that these observations show the possibility of investigating certain γ-ray lifetimes in the range 10^{-14} sec upwards. (auth)

6162
THE ENERGY DISTRIBUTION OF ALPHA-PARTICLES EMITTED FROM NUCLEAR DISINTEGRATIONS. P. E. Hodgson. Phil. Mag. (7) 43, 934-41(1952) Sept.

The energy distributions of the α particles emitted from small nuclear disintegrations caused by cosmic radiation in photographic emulsion have been found. These are analyzed into the parts due to the light and the heavy elements of the emulsion, and the variation of nuclear temperature and effective potential barrier height with star size is found for each. (auth)

6163
RESONANCE EFFECTS IN THE PHOTO-DISINTEGRATION OF ^{16}O NUCLEI INTO FOUR α-PARTICLES. D. L. Livesey and C. L. Smith. Proc. Phys. Soc. (London) A65, 758-60 (1952) Sept. 1.

The nature of the excitation function of the $O^{16}(\gamma,4\alpha)$ reaction, the disintegration mechanism, and possible excited levels of intermediate Be^8 and C^{12} nuclei have been investigated by irradiating Ilford C2 nuclear plates in a synchrotron beam of 32 Mev maximum energy. Novel α group structures were noted. A new C^{12} level at 11.3 Mev is indicated. There is evidence that a 4.3-Mev excited state of Be^8 is involved. It would seem that the photodisintegration of O^{16} into four α particles is, at least partly, a resonance process for γ rays below 30 Mev, and that in the lowest energy group there are alternative modes of disintegration via Be^8.

6164
PILE NEUTRON ABSORPTION CROSS SECTIONS OF LEAD 206 AND 207. K. L. Aitken, D. J. Littler, E. E. Lockett, and G. H. Palmer. Proc. Phys. Soc. (London) A65, 761 (1952) Sept. 1.

The thermal neutron absorption cross sections σ of natural Pb (1.46% Pb^{204}, 23.94% Pb^{206}, 22.32% Pb^{207}, and 52.27% Pb^{208}) and radiolead (88.19% Pb^{206}, 8.86% Pb^{207}, and 2.95% Pb^{208}) were measured in the GLEEP oscillator. From the respective values 162 ± 5 and 84 ± 3 mb, the assumed value of 0 for Pb^{204}, and the published value of 0.45 mb for Pb^{208}, the authors calculate $\sigma(Pb^{206})$ and $\sigma(Pb^{207})$ to be 25 ± 5 and 698 ± 25 mb, respectively.

6165
THE DEUTERON STRIPPING REACTION WITH ALUMINIUM. J. R. Holt and T. N. Marsham. Proc. Phys. Soc. (London) A65, 763-4(1952) Sept. 1.

Angular distributions of the proton groups from the $Al^{27}(d,p)Al^{28}$ reaction initiated by 8-Mev deuterons have been measured and discussed theoretically. For the Al^{28} ground state the results are consistent with a neutron being captured directly into an s-orbit. The first excited state of Al^{28} is formed by the capture of neutrons with zero orbital momentum with a probability about 10% of that for the capture of neutrons with two units of orbital momentum. If it is assumed that the neutron is finally bound in the nucleus with the same orbital angular momentum with which it is captured, the results show that its final state in Al^{28} is not a pure d-state, but has a 10% admixture of s-state. The reaction is thus a case of a transition with double l values.

6166
ARTIFICIAL ACTIVITY INDUCED IN CARBON BY FAST ^3He IONS. J. H. Fremlin. Proc. Phys. Soc. (London) A65, 762-3(1952) Sept. 1.

Graphite was bombarded with 18.5- and 20-Mev He^3 ions at several beam concentrations. Both C^{11} and N^{13} activities were observed. If the N^{13} was produced from C^{12} the integrated cross section for its production was about one-third of that for C^{11}, while if it was produced from C^{13} it must have been 30 times as great.

6167
ANGULAR DISTRIBUTIONS OF PARTICLE GROUPS FROM DEUTERON BOMBARDMENT OF NEON. R. Middleton and C. T. Tai. Proc. Phys. Soc. (London) A65, 752-7(1952) Sept. 1.

The angular distributions of nine proton groups, the elastically scattered deuteron group, and an inelastically scattered deuteron group from the 8-Mev deuteron bombardment of neon have been investigated using the photographic plate technique. The absolute differential cross sections for the production of the various groups have been calculated, and the spins and parities of some of the states of the residual nucleus Ne^{21} determined. (auth)

6168
THE ANGULAR DISTRIBUTION OF LONG-RANGE ALPHA-PARTICLES FROM THE BOMBARDMENT OF BORON-11 BY PROTONS. D. M. Thomson, A. V. Cohen, A. P. French, and G. W. Hutchinson. Proc. Phys. Soc. (London) A65, 745-52(1952) Sept. 1.

The angular distribution of α particles of long range from the reaction $B^{11}(p,\alpha)Be^8$ has been studied over the range 130 to 280 kev proton energy. A strong anisotropy varying with energy is observed which can be explained in terms of an interference between states of opposite parity in C^{12}. The theoretical analysis gives the result that the well-known 16.11-Mev level in C^{12} formed by resonant capture of 162-kev protons in B^{11} has spin 2 and even parity. (auth)

6169
DEUTERON PRODUCTION IN THE COLLISION OF HIGH ENERGY NEUTRONS WITH NUCLEI. B. H. Bransden. Proc. Phys. Soc. (London) A65, 738-44(1952) Sept. 1.

The production of deuterons in high-energy collisions of neutrons with nuclei has been explained in terms of a direct "pick-up" process by Chew and Goldberger and by Heidmann, the reaction being of the form nucleus A + neutron → nucleus B + deuteron. Here it is shown that an alternative reaction, in which the incident neutron interacts with a nucleon in the target nucleus, which in turn picks up a second nucleon to form a deuteron, is more important at incident energies greater than approximately 200 Mev (nucleus A + neutron → neutron + nucleus B + deuteron). The total cross section for deuteron production is calculated numerically for energies of the incident neutron in the range 100 to 300 Mev, and comparison is made with the results of the direct pick-up theory. (auth)

6170
STATISTICAL FLUCTUATIONS IN NUCLEAR EVAPORATION. K. J. Le Couteur. Proc. Phys. Soc. (London) A65, 718-37(1952) Sept. 1.

Previous treatments of nuclear evaporation have dealt with average values, neglecting fluctuations. In the present paper the fluctuations are considered in detail. The distributions of the number of neutrons and of the total energy associated with evaporation stars of a given size and the size distribution of stars of given total energy, are evaluated explicitly. Knowledge of the fluctuations is useful for interpretation of data concerning small stars, such as those produced by π-meson capture or by artificially accelerated particles. The fluctuations are not very important in the large stars and do not modify any of the results of the author's previous

mean-value calculations (NSA 4-4363, 4-4985). The analysis of the mean evaporation process has also been put into a simplified form, from which numerical results can easily be obtained. The method has been used to compare experimental data with various theoretical energy-temperature relations; the Fermi gas law previously used by the author seems to be the most satisfactory connection between the high-energy star data and the observed level density at low energies. (auth)

6171

NEUTRONS FROM THE DISINTEGRATION OF PHOSPHORUS BY DEUTERONS. S. C. Snowdon. Phys. Rev. 87, 1022-5(1952) Sept. 15.

The neutron spectrum at 0° and 90° from the $P^{31}(d,n)S^{32}$ reaction has been investigated using nuclear emulsions. The energies of the excited states in S^{32} are 0.5, 1.5, 2.2, 2.7, 3.3, 3.8, 4.1, 4.5, 4.9, 5.2, and 5.5-Mev, each with an uncertainty of about ±0.1 Mev. (auth)

6172

DISTRIBUTIONS-IN-ENERGY FOR ALPHA-PARTICLES AND PROTONS FROM U^{235} FISSION. David L. Hill. Phys. Rev. 87, 1049-51(1952) Sept. 15.

The Ranger has been applied to obtain the distributions-in-range for the α particles and protons emitted from a thin film of U^{235} irradiated by thermal neutrons. For the α particles the corresponding distribution-in-energy was obtained from 5.2 to 50 Mev, showing appreciable intensity above 35 Mev and being well approximated in the high-intensity region by a gaussian curve centered at 15.2 Mev and with a 4.3-Mev rms half width. The total intensity observed in this energy region corresponds to one α particle in 220 fissions. The proton intensity was found to be low above 2.1 Mev but to rise sharply as the energy was diminished to the limit of observation at 1.4 Mev, indicating about one proton with an energy in excess of 1.4 Mev emitted per 5000 fissions. (auth)

6173

THE NEUTRON ENERGY SPECTRUM FROM U^{235} THERMAL FISSION. David L. Hill. Phys. Rev. 87, 1034-7(1952) Sept. 15.

A Ranger measurement of the distribution-in-range of knock-on protons from thin paraffin layers indicates the distribution-in-energy from 0.4 to 7 Mev of the neutrons emitted from U bombarded by neutrons from the thermal column of the Argonne heavy water reactor. The spectrum shows a broad maximum near 0.75 Mev and follows closely an exponential drop from 2 to 7 Mev with a relaxation energy of 1.55 Mev. The observed neutron intensity does not go to zero below 16 Mev. (auth)

6174

ELECTRON EXCITATION OF NUCLEI. Joseph A. Thie, Charles J. Mullin, and E. Guth. Phys. Rev. 87, 962-5(1952) Sept. 15.

The cross section for an electric 2^l-pole transition produced by the electromagnetic field of fast electrons is derived in the Born approximation. Electric dipole-quadrupole interference is also obtained. Deuteron electrodisintegration is further developed, the theory now extending to 150-Mev energy transfers. Characteristic features of electron excitation experiments are mentioned, in particular the possibilities of obtaining information about nuclei and of observing the scattered electrons. (auth)

6175

EXCITATION CROSS SECTION FOR HELIUM ATOMS. Saul Altshuler. Phys. Rev. 87, 992-4(1952) Sept. 15.

The excitation scattering of electrons from He atoms is investigated in order to examine quantitatively the errors introduced by the fact that the description of the He target is only approximately known. The cross section is calculated in Born approximation using formally equivalent matrix elements which weight the wave functions differently in space. Similar shapes for angular distribution and total cross section vs. energy curves are obtained although absolute values differ. (auth)

PARTICLE ACCELERATORS

6176

Brookhaven National Lab.

THE STRONG-FOCUSING SYNCHROTRON—A NEW HIGH ENERGY ACCELERATOR, by Ernest D. Courant, M. Stanley Livingston and Hartland S. Snyder. [nd] 21p. (BNL-1218)

Strong focusing forces result from the alternation of large positive and negative n-values in successive sectors of the magnetic guide field in a synchrotron. This sequence of alternately converging and diverging magnetic lenses of equal strength is itself converging, and leads to significant reductions in oscillation amplitude, both for radial and axial displacements. The mechanism of phase-stable synchronous acceleration still applies, with a large reduction in the amplitude of the associated radial synchronous oscillations. To illustrate, a design is proposed for a 30-bev proton accelerator with an orbit radius of 300 ft, and with a small magnet having an aperture of 1 × 2 in. Tolerances on nearly all design parameters are less critical than for the equivalent uniform-n machine. A generalization of this focusing principle leads to small, efficient focusing magnets for ion and electron beams. Relations for the focal length of a double-focusing magnet are presented, from which the design parameters for such linear systems can be determined. (auth)

6177

Brookhaven National Lab.

RADIAL FOCUSING IN THE LINEAR ACCELERATOR, by J. P. Blewett. [nd] 9p. (BNL-1219)

The focusing mechanism described in BNL-1218 is applied to the linear accelerator. The defocusing forces in the linear accelerator are derived and the particular example of a 4-Mv accelerator 10 meters long is discussed. It is shown that the defocusing forces can be compensated by magnetic or electric lenses of the alternating gradient type using easily attainable field gradients. For example, a defocusing field gradient of 1000 v/cm on a 100-kv proton beam can be compensated by a lens 20 cm long with field gradients of the order of 1000 gauss/cm. (auth)

6178

THE X-RAY SPECTRUM FROM A 70 MEV SYNCHROTRON. I. B. McDiarmid. Phil. Mag. (7) 43, 1003-5(1952) Sept.

The spectrum of the x rays produced in the forward direction by 70-Mev electrons striking a conventional thick W target was measured. The scattering method was used to determine the energies of 637 electron pairs produced by the x rays in G5 emulsions, and from this the spectrum has been deduced. The number of photons found below 25 Mev is considerably less than that predicted by the Bethe-Heitler-Schiff theory corrected for target thickness.

RADIATION ABSORPTION AND SCATTERING

6179

Palmer Physical Lab., Princeton Univ.

SOME DATA ON THE ELASTIC SCATTERING OF 18.3 MEV PROTONS, by P. C. Gugelot. June 12, 1952. 8p. (NYO-3660)

The absolute differential cross sections for elastic scattering of 18.3 ± 1-Mev protons by Al, Fe, Ni, Cu, Ag, Sn, and Pt are presented.

6180

Radiation Lab., Univ. of Calif., Berkeley

EFFECT OF CHEMICAL STRUCTURE ON STOPPING POWERS FOR HIGH-ENERGY PROTONS (thesis), by Theos Jardin Thompson. Aug. 11, 1952. 95p. (UCRL-1910)

An abstract of this report was indexed as report UCRL-1555 and appears in Nuclear Science Abstracts as NSA 6-716.

6181
SCATTERING OF FAST ELECTRONS BY LIGHT ATOMIC NUCLEI. Stanislaus Kronenberg. Acta Phys. Aust. 5, 536-43(1952) June. (In German)

The series expression for the dependence of intensity on scattering angle first derived by Mott by exact integration of the Dirac equation has been modified by many authors. The problem is once again carried through; the results show that only the equation given by McKinley and Feshback (Phys. Rev. 74, 1759(1948)) is correct and valid for all scattering angles.

6182
PHOTOELECTRIC ABSORPTION OF γ RAYS IN THE L SHELL OF ATOMS. Nadine Marty. J. phys. radium 13, 401-4(1952) July-Aug.-Sept. (In French)

The K/L ratio of photoelectric absorption cross sections was measured with a semicircular spectrometer for 411- and 140-kev photons and U, Pb, Au, and Ag targets in the first case, Au and Ag in the second. The results were: Ag, 14; Pb, 25 to 27; Au, 25 to 27; U, 31%.

6183
ENERGY EXPENDITURE PER ION PAIR FOR ELECTRONS AND α-PARTICLES. J. M. Valentine and S. C. Curran. Phil. Mag. (7) 43, 964-7(1952) Sept.

Work on the energy expenditure per ion pair, V, by means of end-corrected ion chambers and proportional counters was extended to include ionization by Po α particles. The gases argon, He, H_2, N_2, air, O_2, and methane were studied. Curves of ion current against percentage of argon admixed with the other gases are plotted and the ratio V_{gas}/V_{argon} determined in each case. Previous values of V obtained with electrons are discussed and small differences in the corresponding values in V in the electron and α-particle cases are noted. (auth)

6184
THE CALCULATION OF SCATTERING AMPLITUDES. G. J. Kynch. Proc. Phys. Soc. (London) A65, 708-18(1952) Sept. 1.

In two earlier papers (see NSA 6-2543, 6-2544) a differential equation was given for the asymptotic phases required in the two-body scattering problem. The method implied a resolution of the wave function into eigenfunctions of the orbital or total angular momentum as the potential was central or noncentral. This feature can be avoided, and in this paper an integro-differential equation is given for the total scattering amplitude corresponding to a given incident wave. It can be applied to any scattering or ionization problem, single or multiple, where no particles are bound after scattering which were not bound before. The method is applicable to the Schroedinger or Dirac equations. If used with time-dependent equations the usual time-dependent perturbation theory results, owing to the apparent necessity of adhering to a definite time distinction between initial and final states. The same is true for the quantized field equations in the Heisenberg representation. (auth)

6185
ELASTIC SCATTERING OF GAMMAS BY BOUND ELECTRONS. P. Greifinger, J. Levinger, and F. Rohrlich. Phys. Rev. 87, 663(1952) Aug. 15.

Calculations of 180° Rayleigh scattering of Co^{60} 1.332-Mev γ rays by K electrons of Pb are reported. The results are compared with the form-factor calculation of Bethe, which is based on Dirac wave functions for the K electrons. The dispersive scattering amplitude is about half Bethe's form factor, while the absorptive scattering amplitude is surprisingly large. The results may be modified appreciably by binding effects in the intermediate state.

RADIATION EFFECTS

6186
Atomic Energy Research Establishment, Harwell, Berks (England)
ADSORPTION ON IRRADIATED GRAPHITE, by L. E. J. Roberts. Apr. 15, 1952. 10p. (AERE C/M-144)

The adsorption of A at temperatures of −116°C, −139°C, and −196°C and the chemisorption of O_2 at 0°C on irradiated and nonirradiated samples of the same graphite dust have been measured and compared. No large effect due to irradiation was observed. The dust was irradiated in vacuo in the NRX pile to a total dose equivalent to 4×10^{19} n/cm² in BEPO. (auth)

6187
AVERAGE ENERGY OF SECONDARY ELECTRONS IN ANTHRACENE DUE TO GAMMA-IRRADIATION. G. D. Prestwich, T. H. Colvin, and G. J. Hine. Phys. Rev. 87, 1030-1(1952) Sept. 15.

The average energy of the electrons produced in anthracene scintillators by γ rays in the energy range from 0.28 to 2.76 Mev is determined experimentally. The values obtained are in good agreement with theory. Above 1-Mev γ-ray energy, crystal size is shown to be of importance due to leakage of high-energy electrons from the crystal surfaces. (auth)

RADIOACTIVITY

6188
Argonne National Lab.
ON THE ONE-BODY MODEL OF ALPHA RADIOACTIVITY. I. SURVEY OF THE EXISTING RESULTS, by G. H. Winslow and O. C. Simpson. June 1952. 48p. (ANL-4841)

In part I various aspects of the so-called one-body model of α decay are described. Some of the equations, derived on the basis of this model, which have been commonly used for calculation of nuclear radii are listed, and the numerical results of such calculations compared. In part II the authors present two new derivations for S-state emission. Each is for the same form of potential function, but in one case this form is obtained as a limiting case of a more general form. The equations listed in part I are then compared with those found in part II, and reasons for the differences are shown. In part III, a derivation for non-S-state emission is attempted along the lines used for S-state emission in part II, and the problem of the analysis of several α groups from the same species is discussed on the basis of the results obtained. In part IV, α-decay data are collected, radii calculated, and analysis of those species which show several α groups is attempted.

6189
Brookhaven National Lab.
A SCINTILLATION SPECTROMETER STUDY OF THE DECAY OF Tl^{204}, by E. der Mateosian and A. Smith. [nd] 26p. (BNL-1246)

By means of a special technique of scintillation spectroscopy, whereby radioactivity is introduced into a NaI(Tl) crystal, the β spectrum of Tl^{204} is investigated, and the assignment of the transition as "first forbidden" is confirmed. A reported weak intensity photon radiation of 70-kev energy is uniquely identified as being due to K-electron capture and the branching ratio of the K capture process to the beta emission is determined to be ~0.015. Utilizing the formulas for forbidden β transitions developed by Marshak, the transition energy for the orbital capture is calculated to be ~400 kev. The inner bremsstrahlung associated with the K capture is detected by coincidence measurements and its endpoint value is found to be in agreement with the transition energy calculated from the branching ratios. An upper limit of 0.2% is set for any possible K capture in Au^{198}. (auth)

6190
Yale Univ.
RADIATIVE K-CAPTURE IN A^{37}, by C. E. Anderson, G. W. Wheeler and W. W. Watson. [nd] 4p. (NYO-3021)

By spectrometric observation of the continuous γ-ray spectrum of A^{37}, a pulse-height distribution was obtained which agrees roughly with that to be expected from the predicted distribution. Another analysis by means of a calculated absorption curve in Pb for the theoretical distribution also seems to agree with the absorption curve observed.

6191
Rochester Univ.
ON THE VERY LONG LIFETIME OF C^{14} β-DECAY, by A. M. L. Messiah. July, 1952. 4p. (NYO-3213)

The difficulty in β-decay theory due to the long lifetime of C^{14} and explanation of the large C^{14} ft value are discussed in terms of L forbiddenness. The experimental verification of the L assignments of C^{14} and N^{14} and difficulties arising in explanations of the long life of C^{14} in terms of existing one-particle models are examined.

6192
THE DECAY OF THE 2.4 MEV LEVEL IN ^{9}Be. G. A. Dissanaike and J. O. Newton. Proc. Phys. Soc. (London) A65, 675-6(1952) Aug. 1.

Neutron emission as an alternative to γ emission from the 2.4-Mev level in Be^{9} was observed in studies of the $B^{11}(d,\alpha)Be^{9*}$ reaction. A liquid terphenyl-toluene phosphor was used to detect the γ and neutron radiations from a separated B^{11} target bombarded with 425-kev deuterons.

6193
INTERNAL CONVERSION ELECTRONS FROM THE ^{233}U DECAY. K. Maack Bisgård. Proc. Phys. Soc. (London) A65, 677-8(1952) Aug. 1.

Two excited states of Th^{229} at 43 and 99 kev are suggested by grain-count-distribution studies of the conversion electrons emitted from U^{233} decay in Ilford G5 emulsion.

6194
ON THE THEORY OF BETA-RADIOACTIVITY. A. M. Smith. Phil. Mag. (7) 43, 915-33(1952) Sept.

A comparison of some experimental β spectra with theoretical predictions when the interaction is taken as a linear combination of the five usual forms has been made, and on this basis the conclusion is that the interaction can only be a mixture of the vector and tensor forms. For two disintegrations involving light nuclei the arbitrariness in the theoretical predictions has been reduced by assuming a shell structure of nuclei and evaluating the nuclear matrix elements involved. From this analysis it is concluded that the interaction responsible for β decay is a mixture of approximately two parts of vector form to one of tensor. (auth)

6195
K/β^{+} BRANCHING RATIO OF Zn^{65}. Tosiko Yuasa. Comp. rend. 235, 366-8(1952) Aug. 4, (In French)

The intensities of the K-capture Auger electrons and the β^{+} spectrum of Zn^{65} were measured in a 180° magnetic spectrograph. The total branching ratio $K/\beta^{+} = 41 \pm 5$ was found. The β^{+} spectrum does not have the shape of a simple spectrum of a permitted transition.

6196
MEASUREMENT OF THE K-CAPTURE/β^{+}-EMISSION BRANCHING RATIO OF Kr^{79}. Pierre Radvanyi. Compt. rend. 235, 289-91(1952) July 28. (In French)

Kr^{79}, entrained in air, was introduced into a cloud chamber, where its K/β^{+} ratio was measured by counting the Auger K-electron and positron tracks originating in a given volume. The ratio was found to be 14.1 ± 4.0, which is not consistent with Bergström's proposed decay scheme. In the latter almost all decays go to the 263-kev level of Br^{79}. A new decay scheme is proposed in which 54.7% of the Kr^{79} disintegrations go by K capture and 6.6% by β^{+} emission to the Br^{79} ground state, 38.2% going by K capture and 0.5% by β^{+} emission to the 263-kev level.

6197
GAMMA SPECTRUM OF Br^{82}. B. Dzhelepov and A. Silant'ev. Doklady Akad. Nauk. S.S.S.R. 85, 533-5(1952) July 21. (In Russian)

Gamma rays of energies (relative intensities in parentheses) 535 (3.68), 602 (-), 750 (3.53), 1020 (1.00), 1292 (0.85), and 1445 (0.40) kev were observed in a γ-ray spectrometer study of Br^{82}. These values are compared with those of previous investigations.

6198
GAMMA SPECTRUM OF Cs^{134}. K. Gromov and B. Dzhelepov. Doklady Akad. Nauk. S.S.S.R. 85, 299-300(1952) July 11. (In Russian)

Gamma rays of energies (relative intensities in parentheses) 585 (1.37), 788 ± 8 (1.00), ~1000 (~0.02), 1150 ± 12 (0.027), and 1348 ± 14 (0.031) kev were observed in a γ-ray spectrometer study of Cs^{134}. These values are compared with those of previous investigations.

6199
PSEUDOSCALAR INTERACTION IN THE THEORY OF BETA-DECAY. T. Ahrens, E. Feenberg, and H. Primakoff. Phys. Rev. 87, 663-4(1952) Aug. 15.

In the theory of β decay an approximation to the matrix element is customarily obtained by evaluating the radial part of the lepton wave functions at the boundary of the nucleus. The conventional procedure overlooks the term in $\vec{\sigma}\cdot(\vec{\nabla}L)$, in which is evaluated the radial part of the lepton wave functions at the nuclear boundary after the gradient operation has been performed on them. The expression for the pseudoscalar correction factor for the case $\Delta I = 0$, (yes), derived by the correct procedure, is given. The ratio of the pseudoscalar to the tensor transition probability for $\Delta I = 0$, (yes) is then approximately given, for not too small Z, by the expression

$$(G_P/G_T)^2[(1-\tfrac{1}{2}\Lambda^2)\ Z/1836A^{\frac{1}{3}}.]^2$$

(G_P/G_T) must be about $1836A^{\frac{1}{3}}/Z$ in order that the pseudoscalar interaction should contribute appreciably to $\Delta I = 0$, (yes) transitions.

6200
ON THE NEW THEORY OF ALPHA-DECAY. M. L. Chaudhury. Indian J. Phys. 26, 186-96(1952) Apr.

A detailed discussion is given of the implications of the recent wave-statistical theory of α decay by Kar and Chaudhury (NSA 5-5983). A theoretical formula for the nuclear radius, independent of λ, has been obtained. The values of nuclear radii calculated from this formula are discussed and compared with those assumed in the old theories of α decay. It is shown from the new theory that the spacing of the nuclear energy levels in the radioactive region is of the order of only several volts instead of about 10^{5} ev as obtained from the previous theory of α-decay. The new values of level spacing are in agreement with those expected from the trend of the spacing observed in the experiments of resonance capture of neutrons by elements of atomic weight up to about 200. The nature of variation of the ratio of anomalous scattering to normal scattering indicates the existence of the extranuclear potential of Yukawa type introduced in the new theory. The experiments of Change (Phys. Rev. 69, 73(1946); 70, 632(1946)) on the α-ray spectra of Po^{210} and Ra^{226} which are reported to be in serious disagreement with the α-decay theory of Gamow and of others have been discussed in the light of the new theory. The effect of the extranuclear field introduced has been useful in explaining the above disagreement in a qualitative way. (auth)

6201
CLOUD-CHAMBER STUDIES OF THE PRODUCTION OF LIGHT "POSITIVE PARTICLES" NEAR NEGATIVE BETA-

RAY EMITTERS. Gerhart Groetzinger and Fred L. Ribe. Phys. Rev. 87, 1003-11(1952) Sept. 15.

A series of experiments was performed with a cloud chamber to investigate the nature of the particles producing the positive tracks near negative β-ray emitters reported in various investigations. Special emphasis was laid on the questions of whether the tracks are (1) due to electrons reentering the source and (2) due to electrons emerging from the source multiply scattered to show an apparent positive curvature. While the second possibility can account for only a negligible fraction of the tracks, it is found that, depending upon the source arrangement and the manner of investigating cloud-chamber photographs, a considerable fraction of observed "positive" tracks may be due to electrons which reenter or appear to reenter the source. With stereoscopic analysis and an appropriate source arrangement, the fraction of spurious positive tracks may be reduced to a few percent. With these precautions a ratio for P^{32} of positive particles to electrons of 3×10^{-4} was found. This ratio is increased by covering the source with C or Pb. It is shown that the estimate of two electron masses previously obtained for the mass of these particles by comparing their multiple scattering with that of electrons was not influenced by the difference in the momentum distributions of the two species of particles used in the determination. (auth)

6202

THE DECAY SCHEME OF Ir^{192}. K. I. Roulston and R. W. Pringle. Phys. Rev. 87, 930-1(1952) Sept. 15.

Scintillation spectrometer time-correlation studies of the Ir^{192} disintegration have yielded new information about the Pt^{192} level scheme. Gamma rays have been observed of considerably higher energy than any reported previously. (auth)

SPECTROSCOPY

6203

Spectroscopy Lab., Mass. Inst. of Tech.

A FIXED-FOCUS BROAD-RANGE ECHELLE SPECTROGRAPH OF HIGH SPEED AND RESOLVING POWER, by George R. Harrison, James E. Archer and Jean Camus. July 28, 1952. 26p. (NYO-3407)

From the basic formulas governing echelle performance, simple expressions for echelle and groove dimensions are derived for producing a two-dimensional echelle spectrogram (rectangular array) having any desired characteristics. Several possible mountings of Bausch and Lomb echelles having 200 grooves/in. and resolving powers of 2×10^5 to 5×10^5 have been tested with the objective of covering as much as possible of the spectral range 2000 to 7000 A in a single exposure. The mounting thus far found most satisfactory involves making the light from a horizontal slit parallel with an 8-in. concave mirror of 10.5-ft focus, placing the echelle with its grooves horizontal in the collimated beam nearly over the slit, and illuminating a 21-ft concave grating with its grooves vertical to the slightly diverging parallel beams from the echelle. The spectrograph has more than twice the resolving power of the best 35-ft concave grating, and from five to ten times its speed. Hyperfine structure of Hg and Pr and Zeeman effects of Er and Nd are shown.

6204

INFRARED AND RAMAN SPECTRA OF F_2CO, FClCO, AND Cl_2CO. A. H. Nielsen, T. G. Burke, P. J. H. Woltz, and E. A. Jones. J. Chem. Phys. 20, 596-604(1952) Apr.

This paper combines earlier preliminary reports on F_2CO, FClCO and Cl_2CO into a complete report on the Raman and infrared spectra of these molecules. Details of measurement and handling of the samples are given. The fundamental frequencies observed in both Raman effect (liquid) and infrared (gas) and a large number of overtone and combination frequencies observed in the infrared have been identified and are collected in tables. The observed infrared band envelopes are described and compared with the band envelopes predicted on the basis of the molecular models. Resonance between ν_2 and $2\nu_1$ in F_2CO and ν_2 and $\nu_1 + \nu_4$ in FClCO is discussed. (auth)

THEORETICAL PHYSICS

6205

CONSTRUCTION OF A POTENTIAL FROM A PHASE SHIFT. Res Jost and Walter Kohn. Phys. Rev. 87, 977-92(1952) Sept. 15.

Two methods of constructing a potential, in the form of a series, from a given S phase shift are described. The convergence of one of these is analyzed. Examples show that it can converge comfortably even for potentials which are so strong as to have a bound state. The ambiguity of the potential, connected with the existence of bound states, is discussed in an appendix. (auth)

6206

RELATIVISTIC TWO-BODY PROBLEM. Hideji Kita. Progress Theoret. Phys. (Japan) 7, 217-24(1952) Feb.

Starting from Feynman theory an inhomogeneous and homogeneous integral equations are obtained relativistically for scatterings and bound states of two particles in connection with S-matrix theory. (auth)

6207

THEORY OF SUPER-QUANTIZATION OF QUANTIZED FIELD AND ITS APPLICATIONS. Yasutaka Tanikawa. Progress Theoret. Phys. (Japan) 7, 193-206(1952) Feb.

A new treatment of quantum field theory is proposed by applying the theory of superquantization of the quantized field. As examples of its application, it is shown that the symmetrical treatment of the four potentials of the electromagnetic field is justified without introduction of the indefinite metric for the scalar photon and that the physical interpretation of the regulator theory of Bose field may be given. (auth)

6208

ON THE ANALYTIC BEHAVIOUR OF DYSON TRANSFORMATION FUNCTION. Hiroshi Suura, Yoichi Mimura, and Toshiei Kimura. Progress Theoret. Phys. (Japan) 7, 171-84(1952) Feb.

The detailed properties of the Dyson transformation function, which represents the time development of an initial free state at infinite past due to an interaction, adiabatically switched in and off according to a factor $\exp(-\epsilon|t|/\hbar)$, $(\epsilon > 0)$, were examined in special connection with bound states. The transformation function is unitary, and the power expansion in the interaction hamiltonian is finite and regular in the limit $\epsilon \to 0$, except those matrix elements with respect to the lowest energy free state of the system in question. An initial free state, except the lowest energy one, is transformed at a finite time t into the corresponding unbound eigenstate of the total hamiltonian with the same energy. Transitions to bound states are due to those initial states whose energy falls in the interval of the order ϵ from that of the lowest energy state. (auth)

6209

ON YUKAWA'S THEORY OF NON-LOCAL FIELD. I. THE CASE OF FREE FIELD. Osamu Hara and Haruo Shimazu. Progress Theoret. Phys. (Japan) 7, 255-62(1952) Feb.

The relation of Yukawa's nonlocal field theory to the ordinary local field theory is investigated. It is shown that the equations of motion and the commutation relations of the nonlocal field are derived from those of the local field by a canonical transformation, which means that both fields are equivalent at least in the case of no interaction. The feature of the nonlocal field as a mixed field composed of those with various spins is discussed. The considerations in this paper are all restricted to the free field. (auth)

PATENTS

CHEMISTRY

6210

FLUORINATION PROCESS. R. D. Fowler and H. C. Anderson (to U. S. Atomic Energy Commission). U. S. Patent 2,608,593, August 26, 1952.

This patent covers a method for the perfluorination of a hydrocarbon which is accomplished without scission of the carbon structure of the hydrocarbon. The vaporized hydrocarbon is passed over solid cerium tetrafluoride in a reaction zone at a temperature between ~100° and ~450°C and above the boiling point of the starting hydrocarbon, and subsequently separating from the reaction product a perfluorinated organic compound having the carbon structure of the starting hydrocarbon.

6211

ELECTRODEPOSITION OF METAL SALTS. M. Kahn (to U. S. Atomic Energy Commission). U. S. Patent 2,608,530, August 26, 1952.

This patent covers a process for quantitatively electrodepositing uranium fluoride from a dilute aqueous solution of uranyl nitrate containing dissolved sodium fluoride, the concentration thereof being in the range of 25 to 300 times the concentration of the uranyl nitrate.

6212

PREPARATION OF RADIOACTIVE BROMINE. H. Jacobson (to U. S. Atomic Energy Commission). U. S. Patent 2,605,219, July 29, 1952.

In this method for the preparation of radioactive bromine, a non-volatile bromide salt which has been neutron-irradiated to produce radioactive bromine is mixed with an anhydrous relatively volatile metal bromide which is capable of ionizing in the molten state. The mixture is heated to a temperature sufficient to vaporize a portion of the volatile salt and the vapor of this salt is then brought into contact with natural bromine gas. Thereafter the bromine gas is separated from the vapor of the volatile bromide. The separated bromine gas contains the radioactive bromine as the result of a double exchange process.

6213

METHOD OF PRODUCING ZIRCONIUM TETRAFLUORIDE. H. A. Wilhelm and K. A. Walsh (to U. S. Atomic Energy Commission). U. S. Patent 2,602,725, July 8, 1952.

This process for the production of ZrF_4 comprises reacting a zirconium chloride with gaseous HF at a temperature of about 50°C until at least 90% conversion to ZrF_4 has been effected and then continuing the reaction at 300°C until conversion is substantially complete, thereby obtaining a practically non-hydrolyzable ZrF_4.

6214

METHOD OF CONCENTRATING ISOTOPIC CARBON. M. Calvin and J. W. Weigl (to U. S. Atomic Energy Commission). U. S. Patent 2,602,047, July 1, 1952.

This process of enriching CO_2 with respect to the heavy isotopes of carbon contained therein comprises contacting CO_2, while present to the extent of 0.5 to 10 volume percent in admixture with an inert gas, with chlorophyllic plant life in a closed system, and subsequently separating CO_2 enriched in the heavy isotope from the inert gas mixture.

ENGINEERING

6215

METHOD AND APPARATUS FOR MEASURING TIGHTNESS OF VESSELS. R. B. Jacobs (to U. S. Atomic Energy Commission). U. S. Patent 2,608,855, September 2, 1952.

Accurate measurement of tightness or rate of inleakage of a closed vessel is accomplished by surrounding the vessel under test with helium maintained at a substantially constant concentration, maintaining a substantially constant degree of suction on the interior of the vessel through a conduit, establishing an orifice of known size between the helium and the interior of the suction conduit, taking measurements of the helium concentration in the conduit first with the orifice closed and second with the orifice open, and comparing these measurements to determine the rate of inleakage.

6216

ADJUSTABLE VENTURI ASSEMBLY. W. M. Brobeck and J. G. Dorward, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,606,573, August 12, 1952.

This flow control-indicator assembly is useful under widely variable fluid-flow conditions. The apparatus comprises in part an adjustable Venturi tube in combination with a universal flow indicator.

6217

NICKEL WELDING. R. A. Noland and C. T. Szymko (to U. S. Atomic Energy Commission). U. S. Patent 2,602,871, July 8, 1952.

This process comprises arc-welding Ni and Ni-base alloys, using a shield gas mixture containing from 5 to 15% by volume of hydrogen and from 95 to 85% by volume of argon.

6218

HIGH-SPEED BEARING AND TURBINE. J. T. Serduke and R. O. Webster (to U. S. Atomic Energy Commission). U. S. Patent 2,602,632, July 8, 1952.

In this high-speed rotary air-bearing short-hollow-shaft turbine, the rotor of which is both supported and driven by air, the stator has an internal cylindrical surface with outwardly flaring end surfaces while the rotor is slightly smaller in diameter than the stator cylinder and has short, outwardly flaring end abutments.

PHYSICS

6219

INJECTOR MECHANISM. M. D. Martin (to U. S. Atomic Energy Commission). U. S. Patent 2,609,500, September 2, 1952.

This injector mechanism for particle accelerators employs an electrostatic field to guide accelerated particles past the injector and thus does not interfere with particle acceleration.

6220

FLOW CONTROL. W. W. Walton and R. C. Bowers (to U. S. Atomic Energy Commission). U. S. Patent 2,610,300, September 9, 1952.

This device for automatically controlling the vapor flow to a mass spectrometer comprises means responsive to changes in vapor content in the spectrometer chamber for altering the balance in a bridge network to produce signals which control the operation of a suitable valve.

6221

MEANS FOR MEASURING RADIATION. W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent 2,608,661, August 26, 1952.

This neutron density indicator comprises a pair of blocking-layer-type photocells connected in series opposition relation, means which become luminescent when subjected to neutron irradiation positioned to activate one only of the photocells, and electrical indicating means associated therewith.

6222

DRY CELL ASSEMBLY. E. C. Pitzer (to U. S. Atomic Energy Commission). U. S. Patent 2,607,809, August 19, 1952.

This filler composition for voltaic cells which increases the voltage stability and recoverability of the cell comprises in part the acid form of a base exchange resin admixed with saturated ammonium chloride solution so as to form a paste in electric contact with the single metal electrode in the dry cell.

6223
PORTABLE RADIATION SURVEY INSTRUMENT. H. V. Herndon and R. G. Hoff (to U. S. Atomic Energy Commission). U. S. Patent 2,605,429, July 29, 1952.

A reduction in the response time of a portable radiation survey instrument is accomplished by use of positive feedback development in the input circuit of the amplifier, but exterior to the ionization-chamber circuit.

6224
PULSE GENERATOR. G. F. Schrader (to U. S. Atomic Energy Commission). U. S. Patent 2,605,449, July 29, 1952.

This pulse generating circuit produces pulses of variable duration, controllable by a single variable element over a substantially large range, by providing a pair of gaseous discharge tubes controlled to discharge a section of artificial transmission line and adapted to provide a pulse of variable duration in response to an input pulse.

6225
INSULATOR TESTING APPARATUS. J. D. Gow (to U. S. Atomic Energy Commission). U. S. Patent 2,605,633, August 5, 1952.

This apparatus, for mechanically testing the solder joint between a porcelain bushing and the disk-shaped metal end plate of an insulator, employs an audio oscillator, a sawtooth oscillator connected thereto, the output signal thereof being frequency modulated, and assorted circuitry in order to obtain a trace of the resonant curve of the insulator under test.

6226
METHOD AND APPARATUS FOR MATERIAL SEPARATION. R. R. Wilson (to U. S. Atomic Energy Commission). U. S. Patent 2,606,291, August 5, 1952.

In this linear type of material separator for separating large quantities of mixed isotopes in relatively short periods of time, means are provided for modulating charged-particle beams to effect separation of the components and for analyzing the velocity-modulated charged-particle beams to effect collection of the separated components.

6227
RADIATION COUNTER. J. A. Simpson, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,606,296, August 5, 1952.

Improvements are made in the design of G-M and proportional counters which make it possible to operate such counters with accuracy and reliability at potentials in the range of 125 to 300 volts.

6228
ELECTRONIC ANALYZER. J. H. Parsons (to U. S. Atomic Energy Commission). U. S. Patent 2,605,332, July 29, 1952.

The electrically classifying, cataloging, and accounting of the magnitude distribution of a series of events is accomplished by converting the events into proportional voltage pulses, translating the pulses into linear positions of the beam of a cathode-ray tube, and recording the beam positions with a photographic film or plate to reproduce the displacement distribution.

6229
IONIZATION GAUGE REGULATION. H. G. Neil (to U. S. Atomic Energy Commission). U. S. Patent 2,604,514, July 22, 1952.

This circuit for regulating the electron emission of a filament in a vacuum gage maintains constant the rate of ionization of a gas under varying conditions of pressure.

6230
IONIZATION CHAMBER FOR NEUTRON FLUX MEASUREMENTS. L. W. Mead and F. C. Armistead (to U. S. Atomic Energy Commission). U. S. Patent 2,604,598, July 22, 1952.

This ionization chamber, having a high degree of sensitivity, is particularly suitable for measuring neutron flux by employing materials which have a minimum neutron-induced radioactivity and having electrodes with neutron-sensitive coatings thereon.

6231
CONTROL CIRCUIT. O. B. Rudolph (to U. S. Atomic Energy Commission). U. S. Patent 2,604,612, July 22, 1952.

This full-wave a-c controlled circuit for controlling the power supplied to a load is particularly useful or applicable for controlling the speed of a-c motors. The circuit employs a pair of electric discharge tubes, in back-to back relation, which are controlled by the application of a control signal to one of the tubes.

6232
RADIATION DEVICE AND METHOD OF CONSTRUCTION. J. A. Simpson, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,602,904, July 8, 1952.

This G-M counter is adapted to measure the total activity of a radioactive sample, including soft radiations such as low-energy beta rays. The counter is responsive to radiations emanating through substantially a complete solid angle.

6233
ION INTENSITY CONTROL MECHANISM FOR MASS SPECTROMETERS. M. G. Inghram and Brice M. Rustad (to U. S. Atomic Energy Commission). U. S. Patent 2,602,898, July 8, 1952.

This control system for an ion source comprises a mass spectrometer having an ion source and a collector, an inlet for feeding vapors to said source, and means responsive to the flow of ion current to the collector of said spectrometer for regulating vapor flow to the source.

6234
RADIATION MEASURING INSTRUMENT. C. O. Ballou (to U. S. Atomic Energy Commission). U. S. Patent 2,601,583, June 24, 1952.

This portable radiation instrument is capable of holding its calibration to about 10% for prolonged periods of time under varying atmospheric conditions. In addition to other features, the instrument automatically space-charge-limits the tube to prevent destabilization and damage to the cathode during its warm-up period.

6235
POCKET IONIZATION CHAMBER. J. E. Rose and E. W. Hinspater (to U. S. Atomic Energy Commission). U. S. Patent 2,601,637, June 24, 1952.

This hermetically sealed pocket ionization chamber is adapted to have low leakage and to be readily charged as well as to be easily read. The chamber has in combination a substantially tubular hermetically sealed electrically insulating casing, a tubular outer conducting electrode disposed within and coaxial with said casing, a cylindrical contact element mounted on and coaxial with the exterior surface of the casing, a rod-like inner conducting electrode within and axial of said casing, and pressure type means for making electric contact between each of said electrodes and the exterior of said casing employing a flexible insulating diaphragm, and a gaseous ionizing medium within said casing.

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NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

For a list of the abbreviations used in this section, see NSA, Vol. 6, No. 12B, page "SUPPLEMENT 1".

$_{40}Zr^{95}_{55}$ 35^{d}

β^-	95%	0.37	s
		0.60	
		1.10	
γ		0.73	s;pe$^-$

V. S. Shpinel, Zhur. Eksptl'. i Teoret. Fiz. 21, 1370(1951); Phys. Abs. 55, 6005(1952).

$_{41}Nb^{95}_{54}$ 35^{d}

β^-		0.160	sl
γ		0.77	ce$^-$
		$\alpha_K = 0.0016$	
			E2,M1
		K/L~4	

C. Y. Fan, Phys. Rev. 87, 252(1952).

β^-	100%	0.15	s
γ	100%	0.74	pe$^-$

V. S. Shpinel, Zhur. Eksptl'. i Teoret. Fiz. 21, 1370(1951); Phys. Abs. 55, 6005(1952).

$_{45}Rh^{104}_{59}$ 44^{s}

γ		0.56	scin
	w	1.1	

D. Maeder, P. P Preiswerk, Helv. Phys. Acta 24, 625(1951).

$_{47}Ag^{107}_{60}$

$\sigma(n,\gamma)2.3^{m}$ Ag proportional to 1/E
E_n = 2.3 – 3.1 Mev

S. Yamabe et al. J. Phys. Soc. Japan 7, 140(1952).

$_{47}Ag^{110}_{63}$ 270^{d}

β^-	65%	0.088	
	33%	0.52	
	<2%	2.89	

E_γ	e^-_K/β^-*	K/L + M	
0.116	550	1.8	s;
0.447	35		ce$^-$
0.618	6.5		
0.655	200	4.3	
0.687	16		
0.706	32	6.6	
0.740	5.5		
0.759	31	6.5	
0.815	7.5	4.1	
0.883	62	4.2	
0.932	23	6.5	
1.386	12	6.5	
1.480	1.7		
1.506	5	4.5	

N. M. Anton'eva et al. Doklady Akad. Nauk USSR 77, 41(1951).
*x10^5.

β^-		0.59	s
		2.24	
		2.9	
γ		0.66	s;ce$^-$
		0.68	
		0.71	
		0.79	
		0.89	
		0.93	

V. S. Shpinel, N. V. Forafontov, Zhur. Eksptl'. i Teoret. Fiz. 21, 1376(1951).

$_{48}Cd^{109}_{61}$

(L capture)/(K capture)		
	0.28	scin
E_{dis} ~0.07 + 0.087(E_γ)		

E. der Mateosian, A. Smith, Phys. Rev. 87, 193A(1952); verbal report.

$_{49}In^{114}_{65}$ 50^{d}

γ		0.192	s;ce$^-$
		α_K~5	
		K/L + M = 1.16	
		0.553	s;pe$^-$
		0.711	

V. S. Shpinel, N. V. Forafontov, Zhur. Eksptl'. i Teoret. Fiz. 21, 1376(1951).

1.27 γ 6% of cascade γ's
$\gamma\gamma(\theta)$ consistent with I = 2,2,0

E. D. Klema, F. K. McGowan, Phys. Rev. 87, 524(1952).

$\gamma\gamma(\theta)$ consistent with I = 2,2,0

R. M. Steffen, priv. comm. in Phys. Rev. 87, 524(1952).

$_{53}I^{125}_{72}$

(L capture)/(K capture)		
	0.23	scin
E_{dis} ~0.10 + 0.035(E_γ)		

E. der Mateosian, A. Smith, Phys. Rev. 87, 193A(1952); verbal report.

$_{55}Cs^{130}_{75}$

τ	30^{m}	
K		
β^+	1.97	sl
β^-	0.442	sl
No γ's		scin
$\beta^+/\beta^- = 27.6$		

A. B. Smith et al. Phys. Rev. 87, 454 (1952). I(23 Mev α,n); chem.

$_{55}Cs^{134}_{79}$ 2.3^{y}

γ	30%*	0.570	s;pe$^-$
	100%*	0.601	
	100%*	0.794	
		1.02	
		1.11	
	3%*	1.35	

V. S. Shpinel, Zhur. Eksptl'. i Teoret. Fiz. 21, 853(1951). NSA 6, 742(1952).
*Relative photon %'s.

$_{58}Ce^{144}_{86}$

τ		295^{d}	
β^-	30%	0.170	sr
	70%	0.304	

γ	I(e^-)*	E_γ	K/L
	>0.25%	0.0337	
		0.535	
	~1.9 %	0.0807	~3.5
		0.1003	
	6.1 %	0.1342	8.8

No 0.45 β^-
No 0.041, 0.047, 0.095, 0.231 γ's

F. T. Porter, C. S. Cook, Phys. Rev. 87, 464(1952); 85, 733A(1952). Fission; chem.
*% of 2.97 β in Pr^{144}.

$_{59}Pr^{144}_{85}$	β^-	~5%	0.86	sl	D. E. Alburger, J. J. Kraushaar, Phys. Rev. 87, 448(1952); 86, 633A(1952); 82, 332A(1951). Fission; Ce chem. *Relative photon %'s.
		~5%	2.3		
		90%	2.96		
	γ	91%*	0.695	sl;pe$^-$	
		36%*	1.48		
		100%*	2.18		
	$\gamma\gamma(\theta)$ consistent with I = 1,2,0 or 1,1,0				
	β^-	>98%	2.97	s	F. T. Porter, C. S. Cook, Phys. Rev. 87, 464(1952); 85, 733A(1952).
	γ	w	0.0603	s;ce$^-$	
		<1%	(0.7)	scin	
		<1%	(1.5)	scin	
		<1%	(2.2)	scin	
$_{66}Dy^{165}_{99}$	τ		2.310 ± 0.002^h		R. Sher et al., Phys. Rev. 87, 523(1952). Dy(pile n).
Ho	σ_t(0.026 – 0.5 ev) graph				S. Bernstein et al. Phys. Rev. 87, 487 (1952).
Er	σ_t(0.025 ev) 172				S. Bernstein et al. Phys. Rev. 87, 487 (1952).
	σ_t(0.03 – 0.7 ev) graph				
	Resonance E_0 ~0.45 ev; σ_0 ~1700				
$_{71}Lu^{176}_{105}$ 3.75^h	γ		(0.089)	scin	F. K. McGowan, Phys. Rev. 87, 542 (1952).
			α_K = 1.2 E2		
			$\tau = 1.4 \times 10^{-9}$s		
Hf	σ_t(0.025 ev) 115				S. Bernstein et al., Phys. Rev. 87, 487 (1952).
	σ_t(0.03 – 1.7 ev) graph				
	Resonance E_0 1.1 ev; σ_0 730				
$_{72}Hf^{181}_{109}$	β^-		0.408	sl	C. Y. Fan, Phys. Rev. 87, 252(1952).
		E_γ	α_K	α_{L+M}	
	γ_1	0.130	0.34	0.56	
	γ_2	0.134	~3	~0.4	
	γ_3	0.340	~0.1	~0.02	
	γ_4	0.474	0.024	0.006	
	γ_1 and γ_4, E2. γ_2 and γ_3, M1				
46^d	$[e^-(0.13\gamma)][e^-(0.47\gamma)](\theta)$ b = −0.32				A. H. Ward, D. Walker Walker, Nature 163, 168(1949).
$_{77}Ir^{192}_{115}$ 70^d	β^-		0.66	s	V. S. Shpinel, N. V. Forafontov, Zhur. Eksptl'. i Teoret. Fiz. 21, 1376(1951). *Relative photon %'s.
	γ	4%*	0.207	s;pe$^-$	
		3%*	0.277		
		80%*	0.296		
		80%*	0.308		
		100%*	0.315		
		4%*	0.401		
		1.5%*	0.417		
		w	0.432		
		130%*	0.467		
		6%*	0.478		
		10%*	0.586		
		17%*	0.606		
		6%*	0.614		
$_{79}Au^{196}_{117}$	β^-		0.270	s	P. Staehelin, Phys. Rev. 87, 374(1952). Pt(d).
	γ		0.332	s;ce$^-$	
			0.354		
			0.426		
			α_L~7 × 10^{-3} (Hg)		
			L/M + N ~ 4		
	(0.270β^-)(0.426γ)				
	No 0.175 γ observed				
$_{79}Au^{198}_{119}$	K <0.2				E. der Mateosian, A. Smith, Phys. Rev. 87, 193A(1952); verbal report.
	β^-		0.97	sl	C. Y. Fan, Phys. Rev. 87, 252(1952). Au(pile n).
	γ		(0.411)	ce$^-$	
			α_K = 0.03		
			$\alpha_L = \alpha_M$ = 0.013		
$_{80}Hg^{201}_{121}$	q		0.3	S	K. Murakawa, S. Suwa, J. Phys. Soc. Japan 5, 429(1950).
$_{81}Tl^{204}_{123}$	K 1.5%			scin	E. der Mateosian, A. Smith, Phys. Rev. 87, 193A(1952); verbal report.
	E_{dis} (K)~0.4				
	Hg K x rays			scin	A. C. G. Mitchell, R. S. Caird, Phys. Rev. 87, 388(1952).
$_{82}Pb^{212}_{130}$	γ		0.238		V. S. Shpinel, N. V. Forafontov, Doklady Akad. Nauk USSR 72, 49(1950). Chem. Abs. 1877f (1951).
	K : L_I : L_{II} : L_{III} = 100 : 15 : 0.75 : 0.15				
	K : M : N = 100 : 3.2 : 0.9				
$_{83}Bi^{212}_{129}$	γ		0.287		V. S. Shpinel, R. I. Moshkina, Zhur. Eksptl'. i Teoret. Fiz. 21, 1127(1951). Phys. Abs. 55, 6038 (1952).
			$\tau > 10^{-13}$s		
	No Doppler broadening observed				
	(6.04α)(0.04γ)(θ)				L. A. Kulchitskiĭ, Doklady Akad. Nauk. USSR 73, 1153(1950). Phys. Abs. 54, 2963 (1951).
	I = 1,2,1 50%				
	I = 1,3,1 50%				
	suggests that 0.040 level is double				
$_{83}Bi^{214}_{131}$	γ		0.291	s;pe$^-$	K. C. Mann, M. J. Ozeroff, Canad. J. Res. A27, 164(1949). *Relative photon %'s.
			0.352		
		9%*	0.426		
		4%*	0.450		
		14%*	0.496		
		74%*	0.607		
		13%*	0.781		
		9%*	1.12		
		23%*	1.40		
		100%*	1.77		
		25%*	2.21		
			2.40	Cpt	
$_{84}Po^{210}_{126}$	γ		0.804	scin	R. W. Pringle et al. Phys. Rev. 87, 384 (1952).
	No (0.804 γ)X				

$_{89}Ra^{233}_{144}$	σ(th n,f) <100	S. Peterson, A. Ghiorso, (1947); AECU-2040(1952).
$_{88}Ra^{234}_{146}$	σ(th n,f) ≤0.1 mb	D. Ames, A. Ghiorso, (1947); AECU-2040 (1952).
$_{88}Ra^{235}_{147}$	σ(th n,f) <2	S. Peterson, A. Ghiorso, (1947); AECU-2040(1952).
$_{89}Ac^{227}_{138}$	σ(th n,γ)6.13^{h}Ac 20	S. Peterson (1947); AECU-2040(1952).
	σ(th n,f) <2	S. Peterson, A. Ghiorso, (1947); AECU-2040(1952).
$_{90}Th^{227}_{137}$	σ(th n,f) ~1500	S. Peterson, A. Ghiorso, (1947), AECU-2040(1952).
$_{90}Th^{228}_{138}$	σ(th n,f) <0.3	M. H. Studier, A. Ghiorso, (1947); AECU-2040(1952).
$_{90}Th^{229}_{139}$	σ(th n,f) 45	M. H. Studier et al. (1947); AECU-2040 (1952).
$_{90}Th^{230}_{140}$	σ(n,γ)25.6^{h}Th 61	A. H. Jaffey, E. K. Hyde, (1949).
	σ(th n,f) <1 mb	G. T. Seaborg, W. M. Manning, (1946), AECU-2040(1952).
$_{90}Th^{231}_{141}$	σ(th n,γ)23.5^{m}Th 7.6	L. Seren et al. (1944).
	σ(n,γ)23.5^{m}Th graph E_n = 0.015 – 0.35 Mev	G. A. Linenberger, J. A. Miskel (1946); AECU-2040(1952).
	σ_a(th n) 7.0 osc	H. Pomerance, priv. comm. to K. Way (1948).
	σ_a(pile n) 7.2 osc	D. J. Littler, (1948).
$_{90}Th^{232}_{142}$	σ_a(pile n) 7.2	A. Wattenberg, priv. comm. to H. Goldsmith (1944).
	σ(n,f) graph E_n = 1.25 – 6 Mev	C. L. Bailey et al. (1944–1946); AECU-2040(1952).
	σ_t(0.01 – 2,000 ev) graph E_θ 23, 84 σ_t(0.025 ev) 19.0	W. W. Havens, Jr., L. J. Rainwater, AECD-3288(1951); AECU-2040(1952).
	σ_t(0.15 – 2 Mev) graph	AECU-2040(1952).
$_{90}Th^{233}_{143}$	σ(th n,γ)24.1^{d}Th 1400	E. K. Hyde et al. (1948); AECU-2040 (1952).
$_{91}Pa^{231}_{140}$	σ(n,γ)1.32^{d}Pa^{232} 180	A. H. Jaffey, Q. Van Winkle, (1949); AECU-2040(1952).
	σ(n,f) graph E_n = 0.45 – 3 Mev	C. L. Bailey et al. (1944–1946); AECU-2040(1952).
$_{91}Pa^{232}_{141}$	σ(th n,f) 700	I. Perlman, (1946), AECU-2040(1952).
$_{91}Pa^{233}_{142}$	σ(th n,γ)1.2^{m} + 6.7^{h}Pa 40	L. T. Katzin, F. T. Hagemann (1946); AECU-2040(1952).
	σ(th n,f) <0.1	L. Borst, priv. comm. to K. Way (1948); AECU-2040 (1952).
	σ(th n,f) <1	F. T. Hagemann et al. (1947); AECU-2040 (1952).
$_{91}Pa^{234}_{143}$ 1.14^{m}	σ(th n, f) ≤500	E. Barney et al. (1946); AECU-2040 (1952).
6.7^{h}	σ(th n,f) ≤5000	E. Barney et al. (1946); AECU-2040 (1952).
$_{92}U^{234}_{142}$	τ (2.520 ± 0.008) × 10^{5}y	C. A. Kienberger, Phys. Rev. 87, 520 (1952).